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Natural history of New York.
— [Division VI. — Paleontology.]
Vol. 6.

Geological Survey of the State of New York.

PALÆONTOLOGY:

Vol. VI.

CORALS AND BRYOZOA:

TEXT AND PLATES.

CONTAINING

DESCRIPTIONS AND FIGURES OF SPECIES

FROM THE

LOWER HELDERBERG, UPPER HELDERBERG AND HAMILTON GROUPS.

BY
JAMES HALL,
STATE GEOLOGIST AND PALÆONTOLOGIST.

ASSISTED BY
GEORGE B. SIMPSON.

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STATE OF NEW YORK,
ALBANY, *August*, 1887.

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DEDICATION.

To His Excellency

DAVID B. HILL,

Governor of the State of New York:

SIR:

I have the honor to present a new volume of the Natural History of the State of New York, being a continuation of the work on the PALÆONTOLOGY OF THE STATE OF NEW YORK.

This volume is the sixth of the entire series, and the third published under the provisions of chapter 355 of the laws of 1883, which directed that this work be completed in five volumes beyond those at that time published. It is devoted to the description and illustration of the Corals and Bryozoa of the Lower Helderberg group, and to the Bryozoa of the Upper Helderberg and Hamilton groups, and comprises over three hundred pages of text, and sixty-seven plates, being the full amount of text and plates which could be used, while making a proportionate allowance for the other classes of fossils, already published as Vol. V, part 1, and to be published as Vols. VII and VIII under this title.

The entire number of species described is about 371, which are included under 70 genera and sub-genera. Of this number 328 species are illustrated in the volume. In addition to these about 100 species of the same class of fossils have been critically studied and drawings made for their illustration, but from the restriction limiting the extent of the present volume these could not be included. This does not, by any means, exhaust the number of forms known to occur in these rocks.

The volume must be regarded as only a partial record of our present knowledge upon this class of organisms, but at the same time I believe it will be

found more complete in its illustration of the Palæozoic forms of Bryozoa than any work yet published.

Of the mechanical and artistic execution of the work I may speak in general commendation, and of some portions with unqualified praise. In regard to its scientific merit, I can only express the hope that students in Natural Science, and the enlightened educators of our State and Country, may find this volume a contribution worthy of their acceptance, and a source of material for that higher education and intelligence, which the people of New York so earnestly desire; and in this respect I hope that this volume may commend itself to your Excellency, as worthy of a place among the series of volumes already comprised in the NATURAL HISTORY OF THE STATE OF NEW YORK.

I have the honor to be,
With great respect,
Your obedient Servant,
JAMES HALL,
State Geologist.

ALBANY, *August*, 1887.

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PREFACE.

This volume includes the descriptions and illustrations of the Corals and Bryozoa of the Lower Helderberg group; of the Bryozoa proper, and allied forms, from the Upper Helderberg and Hamilton groups.

When the study of the Broyzoa was begun, the plan of the author contemplated the production of a work, as complete as possible, to illustrate the structure and relations of this class of fossils from the Lower and Upper Helderberg, the Hamilton and Chemung groups. With this object in view, extensive collections were made from all accessible localities. The drawings were commenced and carried on in accordance with this plan, and the better specimens for the illustration of the Genera and Species were figured, while awaiting other collections to supplement the incomplete material already possessed. In this manner some of the groups (or genera) have been very fully illustrated, while others, for want of better material, have been less completely represented.

Although considerable collections had been made in preceding years, it was not until 1874 that the author, with the assistance of Mr. R. P. Whitfield, prepared preliminary descriptions of most of the Corals and Bryozoa of the Lower Helderberg group, at that time known to us; which were published in the Twenty-sixth Report of the State Museum of Natural History. At a later date, while the drawings for the illustrations of these species were in progress, and after their completion, a careful review and revision of the species previously described, and of the new material in hand at that time, was made by

the writer, assisted by the draughtsman, Mr. Geo. B. Simpson. The results of that investigation were published in the Thirty-second Report of the State Museum of Natural History, and the plates having already been lithographed at that time, the species were referred to plate and figure as the same appear in the present volume. These plates with explanations of the figures were communicated with the Report of the State Geologist for 1882, and were published in photo-lithography in 1883. In the same report there were also published ten plates illustrating the Fenestellidæ and other forms of the Upper Helderberg group.

The greater part of the species described and illustrated in this volume have been described in the Annual Reports of the State Museum, the Reports of the State Geologist, and in the Transactions of the Albany Institute. In the Reports of the State Geologist for 1882 and 1884, published in 1883 and 1885, was printed a discussion upon the mode of growth and relations of the Fenestellidæ, which will be completed and published at a future time.

The total number of species from the Lower Helderberg group, described in this volume is one hundred and three, of which two species are not illustrated.* The number of species described from the Upper Helderberg is one hundred and fifty-four, of which thirteen are not illustrated. · From the Hamilton group there are one hundred and twenty-one species described, of which thirty-five are not illustrated in this volume, but it is hoped that they may soon be published through some other medium.

The plates devoted to the illustration of the Lower Helderberg forms, including the Corals proper, are from i to xxiii A. The species of the Upper Helderberg group are illustrated by plates xxv to liv, the Fenestellidæ alone occupying twenty plates. The Bryozoa and Bryozoöid forms of the Hamilton group, which are illustrated, occupy plates lv to lxvi inclusive.

There are some interesting facts connected with the Geological and Geographical distribution of these forms of life, but the space at my command will not admit of a full discussion of this subject.

* The comparatively few forms of Corals proper, in the Lower Helderberg group, rendered their introduction in this volume practicable; but from the Upper Helderberg and Hamilton groups, no attempt has been made to introduce them.

In the Lower Helderberg group the collections of Bryozoa have been chiefly made from the outcrop along the north-eastern base of the Helderberg range, in the neighborhood of Clarksville, Albany county. A less number of forms have come from Schoharie, about twenty miles to the westward of the first locality. Bryozoans are rarely, if at all, seen in this group to the west of Schoharie county. A smaller number of specimens have been obtained at the outcrop of the formation on Catskill creek, and a few at Becraft's mountain, near Hudson. Beyond these points to the southward few forms are known.

In the Upper Helderberg group, the Bryozoa and Bryozoöid forms are comparatively rare in the eastern part of the State of New York. It is not until we reach the central portion of the State that these fossils become conspicuous in a few localities, and their occurrence in these places seems due to the local development of certain sediments, which form no important feature in the entire formation. The best known localities are Onondaga Valley, Caledonia and Le Roy, and from the latter point westward they become more abundant. In Erie county we meet for the first time, so far as observation has been made, a siliceous layer near the base of the formation, which is charged with Bryozoa, especially of the family Fenestellidæ. This deposit is much more fully developed on the west of the Niagara river, containing, in addition to the Bryozoa, Trilobites, Brachiopoda, etc.

The most prolific locality of the Fenestellidæ at present known occurs in the limestone of the Upper Helderberg group, at the Falls of the Ohio river, where these fossils have been silicified and the inclosing calcareous matrix has been removed by solution.

Notwithstanding the comparative dearth of Bryozoa in the Upper Helderberg group in eastern and central New York, the Corals proper abound throughout the entire extent of the limestone from the Hudson valley to the Niagara river.

In the Hamilton group all forms of Bryozoa are extremely rare in the sedimentary deposits of the eastern part of the State. As the shales become calcareous in the central parts of the State, these organisms increase in number, and become abundant in nearly all localities from Seneca lake westward, the most prolific region being that portion of country extending from the Genesee valley to Lake Erie.

The collections for the illustrations of this volume have been chiefly made by myself and by assistants formerly occupied in collecting material for the Palæontology of the State, and later by assistants connected with the State Museum. Collections have been purchased by the author from Mr. Edmond De Cew, and of the late Mr. John De Cew, of Cayuga, Ontario, Canada; the latter having also made special collections for use in this work from the siliceous layers of that part of the Helderberg group in Canada. This work is indebted to Mr. Victor W. Lyon, of Jefferson, Indiana, for important collections made at the Falls of the Ohio. These specimens were in a perfectly preserved condition, and have constituted an important element for the illustration of this volume.

The original drawings have all been made by Mr. George B. Simpson, who has critically studied all the species, and, with the appreciation of a naturalist, has faithfully represented the delicate structure of these organisms in the illustrations accompanying this volume. Credit is due him for the preparation of a large part of the specific descriptions. In the execution of the drawings Mr. Simpson has shown the same artistic ability which has characterized his previous work.

The lithography has been chiefly done by Mr. Philip Ast, of whose ability in reproducing the original drawings upon stone, we cannot speak too highly. A few plates by the late Mr. H. Bergmann, give very accurate and elaborate representation of *Favosites Helderbergiæ* and of species of FISTULIPORA, PTILODICTYA, etc., of the Lower Helderberg group. More recently some plates of the Upper Helderberg and Hamilton groups have been done by Mr. Paul Riemann.

We are indebted to Mr. Charles E. Beecher for the preparation of the Synopsis of the Genera and Sub-genera described and illustrated in this volume; and also for the arrangement of the explanations of plates, with references to the pages of the volume and the localities of the species.

Mr. Beecher and Mr. Simpson have rendered assistance in proof-reading while the volume has been passing through the press.

THE AUTHOR.

ALBANY, *August*, 1887.

SYNOPSIS OF THE GENERA INCLUDED IN THIS VOLUME.

Streptelasma, Hall (Palæontology of N. Y., vol. i, p. 17. 1847).
[Type, Streptelasma expansum, Hall.]

Corallum simple. Lamellæ usually simple, alternate, coalescing in the center, forming a vesiculose core or pseudo-columella. Tabulæ and fossette obscure or obsolete.

The species grouped under this genus, from various geological horizons, show considerable variation in form and character, and pass gradually into the genus ZAPHRENTIS, of which they may be considered as a sub-division or sub-genus.

Example: *Streptelasma strictum*, pl. i, figs. 1–10.

Zaphrentis, Rafinesque (Ann. des Sci. Phys. Brux., vol. v. 1820).
[Type, Zaphrentis phrygia, Rafinesque.]

Corallum simple, conical. Lamellæ simple, alternate, rarely extending to the center; usually arranged in four fascicles, with a well marked septal fossette between the two anterior fascicles. Diaphragms or transverse laminar plates numerous, extending from wall to wall and deflected downwards around the periphery.

The species illustrated and described in this volume, from the Lower Helderberg group, offers a very good illustration of the uncertainty of many of the characters which are often considered as of specific importance. The fossette is variously developed, and is not constant in its position in the cup. The lamellæ are also subject to much variation in their number and extent; sometimes they extend quite to the center and become irregular and involved; in other examples again they extend not more than one-third the radius of the cup, and expose the central area of the diaphragm.

Example: *Zaphrentis Roemeri*, pl. i, figs. 11–21.

Aulopora, Goldfuss (Petrefacta Germaniæ, vol. i, p. 82. 1826).
[Type, Aulopora serpens, Goldfuss.]

Colonies of procumbent tubes, usually attached for the greater portion of their length. Tubes increasing by latero-basal gemmation; after budding each

parent tube turns upwards and ceases growth, and the young cells continue the growth of the colony. Tubes without pores, and commonly without diaphragms; sometimes with radiating lamellæ.

Examples: *Aulopora Schohariæ*, pl. ii, figs. 1–6.
Aulopora tubula, pl. ii, figs. 7, 8.

Vermipora, Hall (Twenty-sixth Ann. Rept. N. Y. State Mus. Nat. Hist., p. 109. 1874. [Type, Vermipora serpuloides, Hall.]

Corallum ramose, consisting of continuous serpula-like cell tubes, without intercellular tissue, arising from the center of the branch, and increasing by lateral gemmation. No transverse diaphragms or mural pores have been observed in the typical species of the genus.

Example: *Vermipora serpuloides*, pl. ii, figs. 24–31.

Striatopora, Hall (Pal. N. Y., vol. ii, p. 156. 1852).
[Type, Striatopora flexuosa, Hall.]

Corallum ramose, composed of thick walled tubes arising from the center of the branch, turning outwards to the surface and opening in an expanded aperture. The interior of the tubes is marked by strong longitudinal striæ or ridges, and numerous mural pores connecting the cells; diaphragms often present.

This genus is closely related to Cladopora, from which it is distinguished principally by the greater development of the longitudinal striæ within the cell tubes, and more frequent mural pores.

Example: *Striatopora Issa*, pl. iii, figs. 14, 15.

Michelinia, DeKoninck (Desc. An. Foss. Carb. Belg., p. 29. 1842).
[Type, Manon favosum, Goldfuss.]

Compound hemispherical corals, composed of elongate conical tubes, which are usually in contact for their entire length, and connected by mural pores. Tubes strongly striated longitudinally, and, in the larger species, intersected by numerous coarsely vesiculose diaphragms.

The Lower Helderberg form, referred to this genus, is not a characteristic species, on account of the absence of diaphragms and the few short campanulate cell tubes composing the corallum.

Example: *Michelinia lenticularis*, pl. iii, figs. 1, 2, 3, 5.

Favosites, Lamarck (Cours. de Zool. du Mus. d'Hist. Nat. 1812).
[Type, Favosites alveolata, Lam.]

Massive or branching Corals, composed of polygonal or circular cell tubes, which are intersected by transverse diaphragms and connected by mural pores, and in many species showing twelve longitudinal furrows.

Examples: *Favosites Helderbergiæ*, pls. iv, v and vi.
Favosites conicus, pl. iii, figs. 4, 6–13.

Alveolites, Lamarck (Hist. Nat. An. Sans Vert. 1801).
[Type, Alveolites escharoides, Lam.]

Corals massive, laminar or rarely branching; composed of compressed cell tubes, traversed by longitudinal furrows and intersected by diaphragms. Mural pores large, usually situated near the angles of the tubes. Apertures with the outer margin projecting.

Example: *Alveolites explanatus*, pl. xiii, figs. 15, 16.

Chætetes, Fischer (Oryct. du Gouv. Moscou. 1837).
[Type, Chætetes radians, Fisch.]

Corallum growing in hemispheric or globular masses; base covered with an epitheca. Cells polygonal, contiguous, intersected by straight diaphragms, without interstitial tissue or tubuli.

With our present knowledge, it seems impossible to separate the forms classed with Monotrypa from typical Chætetes.

Examples: *Chætetes colliculatus*, pl. viii, figs. 1–4.
Chætetes monticulatus, pl. viii, figs. 5–7.

Monotrypa, Nicholson (Pal. Tab. Cor., p. 320. 1879).
[Type, Chætetes undulatus, Nicholson.]

Zoarium growing in irregular hemispherical or globular masses. Surface smooth or with monticules of larger cells. Cell tubes contiguous, prismatic, thin-walled and intersected by straight diaphragms. No interstitial cells or spiniform tubuli.

Example: *Monotrypa ? spinulosa*, pl. xvi, fig. 25.

Monotrypella, Ulrich (Jour. Cin. Soc. Nat. Hist., vol. v. 1882).
[Type, Monotrypa æqualis, Ulrich.]

Zoarium ramose, smooth or tuberculated. Cells apparently of but one kind, intersected by straight diaphragms. Walls thin, except in the peripheral region.

Examples: *Chætetes* (*Monotrypella*) *arbusculus*, pl. ix, figs. 1–3, 6–8.
Chætetes (*Monotrypella*) *abruptus*, pl. ix, figs. 9–11.

Ptychonema, n. s. g. [Type, Chætetes tabulatus, Hall.]

Corallum massive or ramose; composed of thin-walled, strongly corrugated cells which are apparently without diaphragms in the typical species.

Example: *Chætetes* (*Ptychonema*) *tabulatus*, pl. ix, figs. 12–15.

Trematopora, Hall (Pal. N. Y., vol. ii, p. 149. 1852). [Type, Trematopora tuberculosa, Hall.]

Zoarium ramose; branches solid. Cells arising from the center of the branch and continuing contiguous to each other until near the surface where they separate, becoming cylindrical and more or less surrounded by spiniform tubuli and interstitial cells. Tabulæ usually present; no mural pores. Cell apertures oval or circular. Interapertural surface sometimes showing evidences of the interstitial cells beneath, but never with conspicuous open mesopores.

Although no true examples of this genus has been noticed among the materials used for the present volume, it is thought best to give a brief synopsis of the genus for comparison with the sub-genera arranged under it and also other closely allied forms.

Trematella, Hall (Report of State Geologist for 1886, advance sheets. Expl. pl. 25. 1886). [Type, Trematella annulata, Hall.]

Zoarium ramose, solid. Cells tubular, in contact below, diverging near the surface, intersected by septa. Interapertural surface marked by pseudo-pores.

Examples: *Trematopora* (*Trematella*) *annulata*, pl. xxv, figs. 22, 23; pl. xxvi, figs. 1, 2.
Trematopora (*Trematella*) *glomerata*, pl. xxv, figs. 4, 5.

Orthopora, s. g., Hall (Report of State Geologist for 1886, advance sheets. Expl. pl. 25. 1886). [Type, Trematopora regularis, Hall.]

Zoarium ramose, solid. Cell apertures arranged in parallel longitudinal rows. Intercellular space solid, or occupied near the surface by minute tubuli destitute of septa.

Examples: *Trematopora* (*Orthopora*) *regularis*, pl. ix, figs. 1–8; pl. xiii, figs. 1–3; pl. xxiii, fig. 1.
Trematopora (*Orthopora*) *subquadrata*, pl. lv, fig. 10; pl. lvi, figs. 1, 6.

Tropidopora, Hall (Report of State Geologist for 1886, advance sheets. Expl. pl. 25. 1886). [Type, Tropidopora nana, Hall.]

Zoarium ramose, solid. Cell apertures arranged in irregular longitudinal rows, separated by sinuous ridges. Interior structure unknown.

Example: *Tropidopora nana*, pl. xxv, figs. 25, 26.

Diamesopora, Hall (Pal. N. Y., vol. ii, p. 158. 1852). [Type, Diamesopora dichotoma, Hall.]

Zoarium ramose, hollow, lined with an epitheca. Peristomes strongly elevated on the posterior margin. Intercellular space solid.

Examples: *Diamesopora constricta*, pl. x, figs. 14–19; pl. xxiii A, fig. 7.
Diamesopora camerata, pl. xxvi, figs. 9, 10.

Acanthoclema, Hall (Report of State Geologist for 1886, advance sheets. Expl. pl. 25. 1886). [Type, Trematopora alternata, Hall.]

Zoarium ramose, solid. Cells arising from a filiform axis; apertures arranged in longitudinal rows separated by ridges. Usually with one or two nodes longitudinally between the cells, which are represented in the interior by short tubuli.

Examples: *Acanthoclema alternatum*, pl. xxv, figs. 8–10.
Acanthoclema scutulatum, pl. lv, figs. 15–17; pl. lvi, figs. 19, 20.

Bactropora, N. G. [Type, Trematopora? granistriata, Hall.]

Zoarium with distant, bifurcations, solid. Base tapering, acute at the apex, striated. Cells tubular, arising from the center of the branch, septate. Apertures arranged in longitudinal rows.

Examples: *Bactropora granistriata*, pl. lxvi, figs. 20–22.
Bactropora curvata, pl. lxvi, figs. 14–16.

Nemataxis, Hall (Report of State Geologist for 1886, advance sheets. Expl. pl. 25. 1886). [Type, Nemataxis fibrosus, Hall.]

Zoarium ramose, solid. Cells arising from a filiform axis, in contact for the greater portion of their length, but separated by a fibrous tissue near the surface. Apertures arranged in longitudinal rows, separated by ridges.

Examples: *Nemataxis fibrosus*, pl. xxv, figs. 30–36.
Nemataxis simplex, pl. lxvi, figs. 17–19.

Callopora, Hall (Pal. N. Y., vol. ii, p. 144. 1852). [Type, Callopora elegantula, Hall.]

Zoarium ramose solid. Cells cylindrical, septate. Apertures circular or oval, often closed by a perforate operculum, marked by radiating ridges. Meso-

pores more or less numerous, sometimes surrounding the cell apertures. Inter-cellular space occupied by septate tubuli.

Examples: *Callopora perelegans*, pl. xii, figs. 10–17; pl. xxiii A, fig. 14.
Callopora multiseriata, pl. xxv, figs. 6, 7; pl. xxvi, figs. 18, 19.

Callotrypa, N. S. G. [Type, Callopora macropora, Hall.]

Zoarium ramose, solid. Cells tubular, arising from the center of the branch, increasing by interstitial addition. Apertures oval or polygonal. Mesopores minute. Inter-cellular space solid or with small tubuli destitute of septa.

Examples: *Callopora* (*Callotrypa*) *macropora*, pl. xi, figs. 25–29; pl. xxiii, figs. 15–19.
Callopora (*Callotrypa*) *unispina*, pl. xi, figs. 35–37.

Cœlocaulis, N. S. G. [Type, Callopora venusta, Hall.]

Zoarium similar to CALLOPORA in general form and in the characters of the cell apertures and inter-cellular structure, but growing in hollow stems, lined with a concentrically wrinkled and finely striated epitheca.

Examples: *Callopora* (*Cœlocaulis*) *venusta*, pl. xii, figs. 20–24; pl. xxiii A, figs. 1–3, 4? 5.
Callopora (*Cœlocaulis*) *aculeolata*, pl. xxvi, figs. 16, 17.

Lichenalia, Hall (Pal. N. Y., vol. ii, p. 171. 1852).
[Type, Lichenalia concentrica, Hall.]

Zoarium explanate or massive. Cells septate, arising from the epitheca; apertures circular or trilobate, sometimes operculate, often denticulate with the posterior portion of the peristome arched and elevated. Interapertural space smooth; intercellular space vesiculose, vesicles irregularly disposed or more regularly superimposed, giving the appearance of walled septate tubuli.

Examples: *Lichenalia ovata*, pl. xxxii, figs. 1–8.
Lichenalia lunata, pl. xxxi, figs. 1–9.

Pileotrypa, S. G., Hall (Report of State Geologist for 1885, advance sheets. Expl. pl. 30. 1886). [Type, Lichenalia denticulata, Hall.]

Zoarium, in its manner of growth and general character, similar to LICHENALIA; but with the posterior portions of the peristomes strongly elevated, and arched with distinct denticulations in the aperture, which in the course of growth form two longitudinal striations along the interior of the cell wall.

Examples: *Lichenalia* (*Pileotrypa*) *denticulata*, pl. xxvi, figs. 21, 22, 26; pl. xxx, figs. 12–20.
Lichenalia (*Pileotrypa*) *pyriformis*, pl. xxxi, figs. 21–27.

Odontotrypa, s. g., Hall (Report of State Geologist for 1885, advance sheets. Expl. pl. 30. 1886). [Type, Lichenalia alveata, Hall.]

The manner of growth and interior structure is similar to LICHENALIA. The oblique trilobate, closely arranged cell apertures, with strongly elevated denticulated margins, forming a crescentic projection over the aperture, constitute the principal characters of this sub-genus.

Example: *Lichenalia* (*Odontotrypa*) *alveata*, pl. xxx, figs. 24–27.

Lichenotrypa, Ulrich (Contributions to Am. Palæontology, vol. i, No. 1, p. 24. 1886). [Type, Lichenotrypa cavernosa, Ulrich.]

Zoarium consisting of thin lamellate expansions, incrusting other objects. In the earlier stages of growth the cell tubes are short and the apertures circular or oval and the inter-apertural space smooth, as in LICHENALIA. In the course of more advanced growth the intermediate space is traversed by thin walls enclosing the apertures in polygonal areas, forming an irregular network. Inter-cellular space vesiculose.

Example: *Lichenalia* (*Lichenotrypa*) *longispina*,* pl. xxv, figs. 11, 12.

Selenopora, s. g., Hall (Report of State Geologist for 1885, advance sheets. Expl. pl. 25. 1886). [Type, Lichenalia circincta, Hall.]

Zoarium explanate, incrusting. Apertures sub-circular, with an elevated denticulate peristome, and situated within polygonal vestibular areas formed by connecting walls which traverse the surface. Interior structure as in LICHENALIA.

Examples: *Lichenalia* (*Selenopora*) *circincta*, pl. xxv, figs. 13–15.
Lichenalia (*Selenopora*) *complexa*, pl. xxxi, figs. 19, 20.

Glossotrypa, s. g., Hall (Report of State Geologist for 1885. Expl. pl. 31. 1887). [Type, Lichenalia paliformis, Hall.]

Zoarium tubular. Cells arising from the epitheca lining the cylindrical frond, intersected by narrow projections (semi-diaphragms) from the cell walls, extending partially across the cell tube. Apertures paliform. Intercellular structure vesiculose.

Example: *Lichenalia* (*Glossotrypa*) *paliformis*, pl. xxxi, figs. 15–18.

Phractopora, Hall (Trans. Albany Institute, vol. x, abstract, p. 12. 1881). [Type, Lichenalia (Phractopora) cristata, Hall.)

Zoarium explanate, free or incrusting, frequently contorted, celluliferous on one or both faces. Surface elevated at irregular intervals into prominent

* Published 1881. This species is identical with *Lichenotrypa cavernosa*, ULRICH. 1886.

crests. Cells tubular, without septa. Intercellular structure vesiculose near the base, septate above.

Example: *Phractopora cristata*, pl. xxi, figs. 36, 37.

Fistulipora, McCoy (Ann. and Mag. of Nat. Hist., vol. 111, p. 130. 1849). [Type, Fistulipora minor, McCoy.*]

Zoarium lamellate or massive, free or incrusting, sometimes ramose, hollow. Cells tubular, septate or non-septate. Interapertural space occupied by angular pits. Intercellular tissue composed of vesicles, sometimes irregularly disposed, at other times regularily superimposed, resembling septate tubuli.

Examples: *Fistulipora intercellata*, pl. xxxii, figs. 15–20.
Fistulipora confertipora, pl. lviii, figs. 1–5.

Favicella, n. g. [Type, Thallostigma inclusa, Hall.]

Zoarium free or incrusting, consisting of a thin expansion. Apertures inclosed in regular polygonal vestibular areas, similar to Selenopora. Surface between the apertures and ridges occupied by minute mesopores. Intercellular structure vesiculose. This genus bears the same relation to Fistulipora, that the forms included under Selenopora bear to Lichenalia.

Example: *Favicella inclusa*, pl. lviii, figs. 21, 22.

Ceramopora, Hall (Pal. N. Y., vol. ii, p. 168. 1852). [Type, Ceramopora imbricata, Hall.]

Zoarium usually incrusting. Cells angular, radiating from one or more centers. Apertures angular, with the posterior margin usually elevated, giving to them an imbricating appearance.

Examples: *Ceramopora maculata*, pl. xvi, figs. 5–11.
Ceramopora labeculoidea, pl. xvi, figs. 1, 2.

Paleschara, Hall (Twenty-sixth An. Rept. N. Y. State Mus. Nat. Hist., p. 107. 1874). [Type, Paleschara incrustans, Hall.]

Zoarium consisting of thin expansions, usually incrusting other bodies. Cells polygonal, in contact, with frequent maculæ of larger cells.

Examples: *Paleschara incrustans*, pl. xvi, figs. 15–21.
Paleschara radiata, pl. xvi, figs. 13, 14.

*Note.—*Fistulipora minor*, McCoy = *Calamopora incrustans*, Phillips, according to Prof. H. A. Nicholson.

Coscinium, Keyserling (Petschora Land, p. 191. 1846).
[Type, Coscinium cyclops, Keyserling.]

Zoarium forming lamellate expansions, celluliferous on both sides and perforated at regular intervals by oval or circular fenestrules. Cells arising from a mesotheca, which is marked by arching undulations of growth and longitudinal striæ. Margins of fenestrules non-celluliferous. Intercellular structure vesiculose.

Examples: *Coscinium striaturum*, pl. xxxiii, figs. 20, 21.
Coscinium striatum, pl. lxiv, figs. 13–15.

Coscinotrypa, Hall (Report of State Geologist for 1885, advance sheets. Expl. pl. xxix. 1886). [Type Coscinium cribiforme, Prout.]

Zoarium consisting of explanate fronds, celluliferous on both sides, with perforations or fenestrules at varying distances. At intervals the surface is raised into angular folds or plications, which continue growth, and in the same manner give off similar elevations. Cells tubular, arising from a mesotheca. Apertures trilobate, denticulated. Intercellular tissue vesiculose. Interapertural space without mesopores.

Example: *Coscinotrypa cribriformis, var carinata*, pl. xxix, figs. 29–35; pl. xxxiii, figs. 22–25.

Coscinella, N. G. [Type, Coscinella elegantula, Hall.]

Zoarium of the same manner of growth and general characters as COSCINIUM but distinguished by the presence of minute, angular pits or mesopores on the surface of the frond between the cell apertures and around the margins of the fenestrules.

Example: *Coscinella elegantula*, pl. lxiv, figs. 9–12.

Ceramella, N. G. [Type, Ceramella scidacea, Hall.]

Zoarium a thin foliaceous expansion, growing from a spreading base, celluliferous on each face. Cells tubular, oblique. Peristomes elevated. Surface marked by numerous sterile maculæ which are usually depressed below the general surface of the frond.

Example: *Ceramella scidacea*, pl. lxiv, figs. 5–8.

Ptilodictya, Lonsdale (Murchison's Silurian System, p. 676. 1839).
[Type, Flustra lanceolata, Goldfuss.]

Zoarium pointed below, articulating into a spreading base; above, a leaf-like expansion, which is sometimes lobed at the distal extremity, celluliferous on

both faces, divided by a mesial lamina. Margin without cells. Apertures circular or sub-quadrate. No intercellular tissue, although some species show minute interapertural pits or tubuli on the surface of the stipe.

Examples: *Ptilodictya tenuis*, pl. xvii, figs. 7–12; pl. xxiii A, fig. 15.
Ptilodictya plumea, pl. lxi, figs. 9–12.

Acrogenia, Hall (Trans. Albany Institute, vol. 10, p. 193. 1881).
[Type, Acrogenia prolifera, Hall.]

Zorium ramose, proliferous; consisting of flattened branches, two proceeding from the truncate termination of the previous one, and continuing growth in the same manner. Branches striated below, flattened and celluliferous above. Intercellular structure vesiculose. Apertures arranged in longitudinal rows.

Example: *Acrogenia prolifera*, pl. lxiii, figs. 7–15.

Stictoporina, N. S. G. [Type, Trematopora claviformis, Hall.]

Zoarium obtusely pointed at the base, enlarging above and becoming flattened; bifurcations few. Cells tubular, arising from a mesotheca. Apertures oval. Inter-apertural space elevated, angular, enclosing the apertures in rhomboidal or polygonal areas.

Example: *Stictopora* (*Stictoporina*) *claviformis*, not figured.

Rhinidictya, Ulrich (Jour. Cinti. Soc. Nat. Hist., vol. v, p. 152. 1882).
[Type, Rhinidictya Nicholsoni, Ulrich.]

Zoarium slender, growing as in STICTOPORA, but with infrequent bifurcations. Cells arranged in alternating longitudinal rows. Peristomes with small granules or spines, which on the interior are continued as tubuli.

The single species referred to this genus, in the present volume, is of doubtful relations, and with equal propriety could be placed under PTILODICTYA.

Example: *Rhinidictya? granulosa*, pl. xvii, figs. 5, 6; pl. xxiii A, figs. 18, 19.

Stictopora, Hall (Pal. N. Y., vol. i, p. 73. 1847).
[Type, Stictopora elegantula, Hall.]

Zoarium ramose, growing from an expanded base which is continuous with the frond. Branches flattened, composed of two layers of cells separated by a mesotheca; margins non-celluliferous. Cells tubular, separated by vesiculose tissue.

Examples: *Stictopora Gilberti*, pl. xxvii, figs. 20–35; pl. xxviii, figs. 21, 22.
Stictopora incisurata, pl. lx, figs. 1–18.

Thamnotrypa, N. G. [Type, Thamnopora divaricata, Hall.]

Zoarium consisting of a main branch or stipe, from which proceed lateral branches at nearly right angles to the main stem, celluliferous on both sides. Cells arising from a mesotheca. Apertures disposed in two ranges on the branches, and in three or sometimes four ranges on the main stipe.

Example: *Thamnotrypa divaricata*, pl. xxxiii, figs. 9, 10.

Tæniopora, Nicholson (Palæontology of Ontario, p. 108. 1874).
[Type, Tæniopora exigua, Nicholson.]

Zoarium ramose, branches triangular or flattened, celluliferous on each face. Cells cylindrical, proceeding from laminæ which radiate from the center to each angle of the branch, or from a simple mesotheca in the flattened branches. Intercellular tissue vesiculose.

Example: *Tæniopora exigua*, pl. lxii, figs. 15–26.

Prismopora, Hall (Trans. Albany Institute, vol. x, p. 158. 1881).
[Type, Prismopora triquetra, Hall.]

Zoarium ramose, consisting of triangular branches, frequently forming irregular groups. Branches with the sides equal or unequal, concave; celluliferous on each side. Cells tubular, arising from mesial plates which extend from the center of the branch to each angle. Intercellular tissue vesiculose.

Examples: *Prismopora triquetra*, pl. xxviii, figs. 8–10; pl. xxix, figs. 9–15.
Prismopora dilatata, pl. lxii, figs. 13, 14.

Scalaripora, Hall (Trans. Albany Institute, vol. x, p. 159. 1881).
[Type, Scalaripora scalariformis, Hall.]

Zoarium consisting of groups of triangular prismatic branches, celluliferous on each face. Sides of branches concave and crossed by transverse, elevated, celluliferous scalæ. Cells tubular, arising from the radiating mesothecæ of the branches and from the mesothecæ of the scalæ. Margins of branches and scalæ non-celluliferous.

Examples: *Scalaripora scalariformis*, pl. xxix, figs. 4–8.
Scalaripora subconcava, pl. xxix, figs. 1–3.

Semiopora, Hall (Trans. Albany institute, vol. x, p. 193. 1881).
[Type, Semiopora bistigmata, Hall.]

Zoarium ramose, flattened, growing from a spreading base. Branches celluliferous on both sides; cells arising from a mesotheca. Apertures separated longitudinally by two minute pits or mesopores.

Example: *Semiopora bistigmata*, pl. lxii, figs. 27–29.

Intrapora, Hall (Trans. Albany Institute, p. 157. 1881).
[Type, Intrapora puteolata, Hall.]

Zoarium as in STICTOPORA. Interapertural space occupied by minute angular pits. Intercellular structure irregularly vesiculose.

Example: *Intrapora puteolata*, pl. xxix, figs. 18–26.

Thamniscus, King (An. Mag. Nat. Hist., 2d ser., vol. iii, p. 389. 1849).
[Type, Ceratophytes dubius, Schlotheim.]

Zoarium ramose, growing in flattened or infundibuliform fronds. Branches frequently bifurcating, not anastomosing or connected by dissepiments, celluliferous on one side. Cells tubular. Apertures circular or oval, sometimes polygonal

Examples: *Thamniscus variolata*, pl. xxii, figs. 34–46.
Thamniscus multiramus, pl. xxxiii, figs. 1–5.

Fenestella, Lonsdale (Murchison's Silurian System, p. 677. 1839).
[Type, Gorgonia antiqua, Goldfuss.]

Bryozoum ramose, forming flabellate or infundibuliform fronds, composed of slender branches celluliferous on one side, connected by transverse processes or dissepiments. Cell apertures in two ranges, separated by a carina or line of nodes.

Examples: *Fenestella Sylvia*, pl. xx, figs. 4–7.
Fenestella variapora, pl. xlv, figs. 1–13; pl. xxxv, fig. 17.

Fenestrapora, s. g., Hall (Report of State Geologist for 1884, p. 36. 1885).
[Type, Fenestrapora biperforata, Hall.]

Bryozoum infundibuliform, branches connected by dissepiments. Cell apertures in two ranges, separated by a carina bearing pores. Non-celluliferous face with conspicuous pores.

Example: *Fenestrapora biperforata*, pl. lxvi, figs. 34–39.

Unitrypa, s. g., Hall (Report of State Geologist for 1884, p. 36. 1885). [Type, Fenestella (Hemitrypa) lata, Hall.]

Bryozoum infundibuliform, branches connected by dissepiments. Cell apertures in two ranges, separated by carinæ, which are elevated, widened at the summit and connected by thin lateral processes or scalæ which are sometimes very closely arranged, at other times distant.

Examples: *Fenestella* (*Unitrypa*) *lata*, pl. lii, figs. 1–10.
Fenestella (*Unitrypa*) *pernodosa*, pl. liii, figs. 1–11.

Isotrypa, s. g., Hall (Report of State Geologist for 1884, p. 37. 1885). [Type, Fenestella (Hemitrypa) conjunctiva, Hall.]

Bryozoum infundibuliform; branches connected by dissepiments. Cell apertures in two ranges, separated by carinæ which are elevated and much thickened above, and connected by distant lateral processes or pseudo-dissepiments, giving to this face of the frond the appearance of the non-celluliferous face. The reverse face of the frond or non-celluliferous face has conspicuous pores, situated on or near the dissepiments.

Example: *Fenestella* (*Isotrypa*) *conjunctiva*, pl. liv, figs. 10–21.

Loculipora, s. g., Rominger (MS.). [Type, Fenestella (Loculipora) perforata, Hall.]

Bryozoum infundibuliform; branches connected by dissepiments. Cell apertures in two ranges, surrounding the fenestrules. Branches and dissepiments carinated; carinæ elevated and much thickened above, having the appearance of the branches and dissepiments of the non-celluliferous face of the frond.

Example: *Fenestella* (*Loculipora*) *circumstata*, pl. liv, figs. 22–25.

Hemitrypa, s. g., Phillips (Pal. Foss. of Cornwall, Devon and West Somerset, p. 27. 1841). [Type, Hemitrypa oculata, Phillips.]

Bryozoum infundibuliform; branches connected by dissepiments. Cell apertures in two ranges, separated by carinæ which are elevated, widened at the summit and connected by scalæ which meet midway and coalesce forming pseudo-carinæ.

Example: *Fenestella* (*Hemitrypa*) *biserialis*, pl. xxii, figs. 13, 16–18.

Polypora, s. g., McCoy (Carboniferous Fossils of Ireland, p. 206. 1845).
[Type, Polypora dendroides, McCoy.]

Bryozoum similar to FENESTELLA in its manner of growth and general characters, but having three or more ranges of cell apertures on the branches.

Examples: *Fenestella* (*Polypora*) *robusta*, pl. xxxiv, figs. 4–7; pl. xxxix, figs. 1–3.
Fenestella (*Polypora*) *hexagonalis*, pl. xxxviii, figs. 14–20.

Ptiloporella, s. g., Hall (Report of State Geologist for 1884, p. 36. 1885).
[Type, Fenestella (Ptiloporella) laticrescens, Hall.]

Bryozoum growing in the same manner as PTYLOPORINA, but with only two ranges of cell apertures on the branches.

Example: *Fenestella* (*Ptiloporella*) *laticrescens*, not figured, p. 171.

Ptiloporina, s. g., Hall (Report of State Geologist for 1884, p. 36. 1885).
[Type, Fenestella (Ptyloporina) conica, Hall.]

Bryozoum infundibuliform or flabellate, having some of the branches much larger than the others. The ordinary branches originate laterally from one or both sides of the primary or larger branches, not bifurcating as in the ordinary forms of FENESTELLA. Cell apertures in three or more ranges.

Examples: *Fenestella* (*Ptiloporina*) *conica*, pl. xliii, figs. 2–4.
Fenestella (*Ptiloporina*) *sinistralis*, pl. xliii, fig. 9.

Ptilopora, McCoy (Synopsis, Carboniferous Fossils of Ireland, p. 200. 1844).
[Type, Retepora flustriformis, Phillips.]

Bryozoum flabellate, consisting of a primary stipe or rachis arising from a spreading base, and having lateral branches connected by dissepiments.

Examples: *Ptilopora striata*, pl. lxvi, figs. 30–33.
Ptilopora infrequens, pl. lxvi, figs. 26–29.

Glauconome, Goldfuss (Petrefacta Germaniæ, vol. 1, p. 100. 1826), as emended by Lonsdale (Murchison's Silurian System, p. 677. 1839).
[Type, Glauconome disticha, Goldfuss.]

Zoarium consisting of a main stem or rachis from which proceed simple lateral branches, at regular intervals, and occasionally branches having the same manner of growth at the primary rachis; celluliferous on one side. Cell apertures in two ranges, often separated by a longitudinal carina.

Examples: *Glauconome sinuosa*, pl. xxxiii, figs. 11, 12.
Glauconome carinata, pl. lxvi, figs. 23, 24.

Ichthyorachis, McCoy (Carboniferous Fossils of Ireland, p. 205. 1844).
[Type, Ichthyorachis Newenhami, McCoy.]

Bryozoum plumose, consisting of a rachis with short lateral branches or pinnules; celluliferous on one side. Cell apertures in two ranges on the branches, and in three or more on the main stem.

Example: *Ichthyorachis Nereis*, pl. xxii, figs. 19–21.

Crisinella, Hall (Report of State Geologist for 1882. Expl pl. xxvi, 1883).
[Type, Crisina? scrobiculata, Hall.]

Zoarium ramose, solid, celluliferous on one face. Cell apertures arranged in oblique, ascending rows from the center to the margin of the branch, peristomes prominent. Interapertural space with large polygonal pits or mesopores.

Example: *Crisinella scrobiculata*, pl. xxxiii, figs. 6–8.

Cystopora, Hall (Trans. Albany Institute, vol. x, p. 161. 1881).
[Type, Cystopora geniculata, Hall.]

Zoarium consisting of an aggregation of ampullate tubular cells, arising from the center of the stipe or branch, enlarging about the middle of their length, turning abruptly outward and much constricted at the aperture. Cell tubes exposed for more than half their length.

Example: *Cystopora geniculata*, pl. lxvi, figs. 7–10.

Clonopora, Hall (Trans. Albany Institute, vol. x, p. 162. 1881).
[Type, Clonopora semireducta, Hall.]

Zoarium ramose, branches consisting of an aggregation of elongate, cylindrical, tubular cells, which at more or less regular intervals become entirely free and turn abruptly outwards in an umbelliform expansion or in alternation. Cell apertures expanded.

Examples: *Clonopora semireducta*, pl. xvi, figs. 3, 4.
Clonopora incurva, pl. lxvi, figs. 5, 6.

Reptaria, Rolle (Leonhard & Bronn, Neues Jahrbuch, p. 810. 1851).
[Type, Reptaria stolonifera, Rolle.]

Zoarium parasitic, procumbent, attached for its entire extent; consisting of a rachis from which proceed laterally, at regular intervals, cylindrical cell

tubes, and at irregular distances tubes which have the same manner of growth as the primary rachis; this mode of growth is continued indefinitely, the fronds covering a comparatively large area. Cell tubes turning abruptly outward at their distal extremities and opening in an aperture parallel with the axis of the branch.

Example: *Reptaria stolonifera*, pl. lxv, figs. 17–19.

Hederella, Hall (Trans. Albany Institute, vol. x, p. 194. 1881).
[Type, Alecto? Canadensis, Nicholson.]

Zoarium parasitic, consisting of a filiform tubular axis, with opposite or alternate lateral budding of simple tubular cells; also of lateral extensions continuing in the same manner of growth as the initial axis.

Examples: *Hederella cirrhosa*, pl. lxv, figs. 12, 13.
Hederella Canadensis, pl. lxv, figs. 1–8, 14 and 16?

Hernodia, Hall (Trans. Albany Institute, vol. x, p. 196. 1881).
[Type, Hernodia humifusa, Hall.]

Zoarium parasitic, consisting of tubular, annulated cells, enlarging to near the aperture; increasing by lateral gemmation, and the buds continue growth in the same manner as the parent tube, so that comparatively large surfaces are often covered.

Example: *Hernodia humifusa*, pl. lxv, figs. 20, 21.

Botryllopora, Nicholson (Geological Magazine. April, 1874).
[Type, Botryllopora socialis, Nicholson.]

Zoarium consisting of small discoid bodies, occurring singly or in groups, connected by vesicular tissue, adherent to foreign bodies by their under surface. Cells tubular, disposed in double, radiating rows, forming alternating ridges. Intercellular space vesiculose.

Example: *Botryllopora socialis*, pl. lxiv, figs. 3, 4.

NOTE.—The restricted number of pages for the foregoing Synopsis has made it necessary to give the briefest possible description in order to notice the entire number of genera in the volume. Much, therefore, has been omitted, especially the comparisons and inter-relations of the genera.

CORALS AND BRYOZOA

OF THE

LOWER HELDERBERG GROUP.

DESCRIPTIONS OF SPECIES.

STREPTELASMA, Hall. 1847.

Streptelasma strictum.

PLATE I, FIGS. 1-10.

Streptelasma (Petraia) stricta, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 114. 1874.
" *stricta*, Hall. Thirty-second Rept. N. Y. State Mus. Nat Hist., p. 142. 1879.
" *strictum*, Hall. Report of State Geologist for 1882. Expl. pl. 1, figs. 1-10. 1883.

Corallum simple, conical, very gradually and regularly enlarging; straight or very slightly curved, except at the apex, which is sometimes more abruptly bent. Exterior marked with strong undulations of growth and numerous fine concentric striæ; external rays very prominent, from forty-five to fifty at a point where the diameter of the corallum is 15 mm.; the increase in number taking place usually at three distinct points, but sometimes at only two.

Calix deep, sides thin and nearly erect; a flat space at the bottom. In one calix, having a diameter of 20 mm., there are fifty-four lamellæ; alternate lamellæ extending only a short distance from the walls at the base of the calix and frequently coalescing with the primary lamellæ.

For some distance below the calix-margin the lamellæ are of the same size, their edges smooth and rounded, becoming sharp below, and their sides often distinctly granulose or spinulose. The primary lamellæ unite and coalesce at the center of the calix, forming an indistinct plate or vesiculose core from 3 to 5 mm. in diameter. Fossette obscure or obsolete.

This species is distinguished by the usually rigid straightness of its form, and the strongly ribbed exterior.

Formation and localities. In the shaly limestone of the Lower Helderberg group, at Catskill creek, Greene county; near Clarksville; at Schoharie and at numerous other localities in the State of New York.

ZAPHRENTIS, Rafinesque. 1820.

Zaphrentis Roemeri.

PLATE I, FIGS. 11-21.

Zaphrentis Roemeri, Edwards & Haime. Monog. des Polypiers Fossiles, Paris, 1851.
" " " " Report of State Geologist for 1882. Expl. pl. 1, figs. 11-21. 1883.

Corallum simple, turbinate, regularly or irregularly curved; acute at base. The exterior often sharply and strongly annulated, with numerous fine concentric striæ, and constrictions caused by intermittent growth; radial costæ very distinct; base acute.

Calix very oblique to the axis of the corallum, sides sloping, bottom broad, marginally depressed, flat or slightly concave at the centre. Fossette commencing at varying distances from the center of the calix, at first forming a deep pit, becoming shallower as it approaches the anterior margin. Lamellæ from eighty to ninety, alternating in size, the smaller ones being merely rudimentary.

The extension of the lamellæ toward the center is subject to great variation; in some specimens the greater part of the tabula remains smooth, the lamellæ extending but a short distance from the margin; in other specimens extending to and becoming irregularly involved at the center. Tabulæ thin and very closely arranged.

The height of different specimens varies from 15 to 90 mm.; but the greater proportion have a height of from 35 to 45 mm., and a diameter at the calix of from 25 to 30 mm.

Formation and locality. In the shaly limestone of the Lower Helderberg group, near Clarksville, N. Y.

AULOPORA, GOLDFUSS. 1826.

AULOPORA SCHOHARIÆ.

PLATE II, FIGS. 1-6.

Aulopora Schoharia, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 110. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 142. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 2, figs. 1-6. 1883.

CORALLUM consisting of elongate, tubular, thick-walled cells, gradually enlarging to the aperture; increasing, sometimes by one individual budding from the basal part of the calix and continuing in direct line; at other times there is a double latero-basal gemmation, the tubes growing at an angle of about 45° to the parent. Exterior transversely wrinkled. All the tubes after budding assume an erect position and cease growth. Diameter at smaller end .8 mm., at aperture 1.5 mm.; length from 5 to 7 mm.

This species is much smaller than the one in the Hamilton group referred to *A. tubæformis*, Goldf. It corresponds more nearly in size to *A. serpens* var. *minor*, Goldf., in *Petrefacta Germ.*, p. 82, pl. 29, fig. 16, but is larger than the figure there given; the extremities of the tubes are more unequal, and the mode of growth and bifurcation differ.

Formation and localities. In the shaly limestone of the Lower Helderberg group, at Schoharie and Clarksville, N. Y.

AULOPORA TUBULA.

PLATE II, FIGS. 7, 8.

Aulopora tubula, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 142. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 2, figs. 7, 8. 1883.

CORALLUM consisting of comparatively short, tubular, cylindrical cells, gradually increasing in size to the aperture; growing in close aggregation from frequent

gemmation. Generally there are two buds from each cell, diverging at an angle of about 45°. Interior striated; exterior transversely corrugated and strongly striated longitudinally. Length of cell tubes about 2 mm.; diameter at the aperture slightly more than 1 mm.

This species differs from *A. Schoharicæ* in its shorter tubes and proportionally greater diameter, its more frequent gemmation and closer aggregation of growth.

Formation and locality. In the shaly limestone of the Lower Helderberg group, Schoharie, N. Y.

Aulopora subtenuis.

PLATE II, FIGS. 9-13 AND 15-18.

Aulopora subtenuis, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist, p. 143. 1879.
In part " " " Report of State Geologist for 1882. Expl. pl. 2, figs 9–20. 1883.

Corallum consisting of elongate, slender, curving, tubular cells, very gradually enlarging to the aperture. Usually increasing by a single gemmation from each cell-tube, but sometimes there are two and very rarely three buds. Tubes usually straight to the point of gemmation, after which they turn abruptly to one side and cease growth as shown in figs. 10 and 11. When there is more than a single gemmation the parent tube continues curving and the buds emanate from the convex or posterior side, as shown in fig. 16. Interior smooth; exterior strongly corrugated and longitudinally striated; many specimens finely granulose. Length about 8 mm.; diameter at the aperture 1 mm., at smaller end .75 mm.

This species may be distinguished from *A. Schoharicæ* by its more slender form, greater length, and by its mode of gemmation. In *A. Schoharicæ*, when two buds proceed from a parent tube, they are at about the same distance from the aperture, one on each side of a central line, while in this species they are in the middle of the posterior part of the tube, in a direct line and sometimes 2 mm. apart. In all the specimens, so far observed, the cells turn to one side and do not turn upward after budding.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Aulopora elongata.

PLATE II, FIGS. 14, 19, 20.

Aulopora elongata, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 143. 1879.
In part " *subtenuis*, " Report of State Geologist for 1882. Expl. pl. 2, figs. 9–20. 1883.

Corallum consisting of comparatively large, cylindrical, tubular cells; increasing by one or two buds from each cell, when two they are opposite. Exterior transversely corrugated and longitudinally striated. Length of tubes about 8 mm.; diameter at aperture 2 mm.

Formation and locality. Lower Helderberg group, Schoharie, N. Y.

VERMIPORA, Hall. 1874.

Vermipora serpuloides.

PLATE II, FIGS. 24–31.

Vermipora serpuloides, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 110. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 143. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 2, figs. 24–31. 1883.

Corallum ramose, composed of contiguous, sub-cylindrical tubes, increasing by lateral gemmation. Branches infrequent, generally diverging at an angle of about 90°; diameter from 3 to 7 mm. Cell tubes flexuose, sometimes flattened or sub-triangular from mutual pressure. Some of the tubes attain a length of 14 mm.; diameter from .75 to 1 mm. Exterior marked by transverse wrinkles of growth, and sometimes by numerous fine concentric striæ and obscure longitudinal striations. Interior smooth.

Dr. Rominger mentions diaphragms and lateral pores, in a form described by him, but with a careful examination of numerous specimens and translucent sections, I have been unable to find either of these characters in the typical species.

Formation and locality. Lower Helderberg group, Schoharie, N. Y.

VERMIPORA ROBUSTA.

PLATE II, FIGS. 32, 33.

Vermipora robusta, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 144. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 3, figs. 32, 33. 1883.

CORALLUM ramose; diameter of branch 7 mm. Exposed portion of the cell-tubes from 6 to 8 mm. in length; diameter at the aperture 2 mm. Surface marked by obscure transverse striæ and undulations.

This species differs from *V. serpuloides* in its much larger size and comparatively shorter cells.

Formation and locality. Lower Helderberg group, Schoharie, N. Y.

VERMIPORA? TORTUOSA.

PLATE II, FIG. 23.

Vermipora? tortuosa, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 144. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 2, fig. 23. 1883.

CORALLUM consisting of an aggregation of elongate, sub-cylindrical tubes, increasing by lateral gemmation. Length of cell tube 4 mm.; diameter at the aperture .50 mm. Surface marked by numerous oblique transverse annulations which give to the cell tubes a twisted appearance.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

STRIATOPORA, HALL. 1852.

STRIATOPORA ISSA.

PLATE III, FIGS. 14, 15.

Striatopora Issa, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 114. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 144 1879.
" " " Report of State Geologist for 1882. Expl. pl. 3, figs. 14, 15. 1883.

CORALLUM ramose; diameter of the branches reaching 10 mm.; composed of thick-walled, tubular cells, arising from the center of the branch, rapidly increasing in size and quite abruptly curving to the surface; cell tubes polygonal, from four to six-sided; unequal in size through the frequent intercalation of young cells; diameter at the surface from 1 to 2 mm.; interior

marked by very strong longitudinal striæ, increasing in number with the size of the cell tube and giving to the margins of the walls a crenulated appearance. Mural pores large, circular, invariably occurring on the longitudinal ridges.

This is the most robust species of the genus yet noticed, and the cells are large in proportion; it is not a common form and is generally found in detached pieces on the weathered surfaces of blocks of limestone.

Formation and locality. In limestones of the Lower Helderberg group, Clarksville, N. Y.

MICHELINIA, De Koninck. 1842.

Michelinia lenticularis.

PLATE III, FIGS. 1, 2, 3, 5.

Michelinia lenticularis, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 113. 1874.
" " " Thirty-second Rept. N. Y. State Mus Nat. Hist., p. 145. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 3, figs. 1, 2, 3, 5. 1883.

Corallum forming small lenticular bodies, the lower surface usually the less convex and covered with a strongly wrinkled epitheca. Cells large and few, usually from seven to twelve; broadly campanulate. Partition walls about 1 mm. thick; strongly marked longitudinally by nodose striations; denticulate on the margins. The number of striations and denticulations varies with the size of the cell.

In a characteristic specimen 20 mm. in diameter, there are eight cells, the central one having a diameter of 11 mm., and the peripheral cells measuring from 6 to 8 mm. across. The entire height of this specimen is 9 mm.

This is a very small species, seldom attaining a diameter, of more than 25 mm., and is distinguished by its large cells and their strongly granulose-striate character. A small individual 10 mm. in diameter shows one large central cell and six smaller ones around the margin, also an incipient seventh cell. Occasionally there are two central cells in large individuals, and the number of peripheral cells in such specimens is from ten to twelve.

Formation and localities. In the shaly limestone of the Lower Helderberg group, near Clarksville and Schoharie, N. Y.

FAVOSITES, LAMARCK. 1812.

FAVOSITES HELDERBERGIÆ.

PLATE IV, FIGS. 1, 2; PLATE V, FIGS. 1-3; PLATE VI, FIGS. 1-8.

Favosites Helderbergiæ, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 111. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 145. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 4, figs. 1, 2; pl. 5, figs. 1-3; pl. 6, figs. 1-8. 1883.

CORALLUM consisting of large, lenticular, depressed convex or hemispherical masses; base covered by a strongly wrinkled epitheca. Cell tubes polygonal; their inner surface showing evidence of a few strong longitudinal striæ. Septa frequent, from ten to fifteen in the space of 10 mm.; thickness equal to that of the cell walls. Mural pores in one or two ranges, comparatively large, circular, with margins distinctly elevated. Cell walls thin, but frequently much thickened near the surface by silicification, and sometimes granulose or spinulose on the inner face. On some specimens the cells, at the surface, are nearly equal, having a diameter of about 1.5 mm.; on other specimens the diameter varies from .66 mm. to 1.5 mm.

On many specimens some of the cell tubes are larger and less angular than those surrounding them, being a little more than 2 mm. in diameter. A single specimen from Cocymans Landing has slightly larger tubes on one portion, while on all the other parts the cells have the ordinary characters.

This species differs from *Favosites Niagarensis*, which it resembles in the size of its cells, in having more numerous diaphragms, and in the mural pores being on the lateral faces instead of at the angles of the cells.

Formation and localities. In the shaly limestone of the Lower Helderberg group, near Clarksville, Albany county. It is here found weathered out from the rock and silicified, frequently a foot or more in diameter. It is also found in several localities in Schoharie county. Smaller specimens of what appear to be the same or a closely allied species occur at Cole's quarry, Herkimer county, N. Y. The species likewise occurs near Cumberland, Md., having the cells uniformly somewhat smaller than those of the New York specimens.

Favosites conicus.

PLATE III, FIGS. 4, 6–13.

Favosites conica, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 112. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 146. 1879.
" *conicus*, " Report of State Geologist for 1882. Expl. pl. 3, figs. 4, 6–13. 1883.

Corallum forming conical masses; flattened at the base, which is covered by a strong epitheca, marked with concentric wrinkles and undulations and radiating undulations formed by the cell tubes. Cells arising from the center of the base and from an undefined central axis and quite abruptly curving to the surface, increasing by interstitial additions; polygonal, from four to eight-sided; diameter at the surface varying from 1.5 to 3.5 mm.; walls comparatively strong; interior with evidences of numerous spinules or small nodes. Septa of about the same strength as the walls, irregularly arranged, varying from eight to fifteen in the space of 10 mm. Mural pores comparatively large, circular, with distinctly elevated margins, disposed in one, two and sometimes three ranges. Where one or two ranges occur the pores are regularly arranged one above the other; where three ranges occur the disposition is more irregular.

The conical form of this species and the irregularity in the size of the cells distinguish it from every other known species of Favosites in the Silurian rocks of New York.

Formation and locality. In the shaly limestone of the Lower Helderberg group, near Clarksville, N. Y., and at Cumberland, Md.

Favosites sphæricus.

PLATE VII, FIGS. 1–12; AND PLATE VIII, FIG. 8.

Chætetes sphærica, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 111. 1874.
Favosites minimus, " (In error) Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 147. 1879.
Not *Favosites sphericus*, Hall. (— Astylospongia) Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 146. 1879.
Favosites sphericus, Hall. Report of State Geologist for 1882. Expl. pl. 7, figs. 1–12. 1883.

Corallum massive, variable in form. Cell tubes polygonal, generally hexagonal; length from 2 to 13 mm. or more; diameter from .25 to .35 mm. On the surface are frequent maculæ .5 mm. in diameter, where the cells are larger

than the others. Cell walls thin; smooth or with transverse wrinkles or striæ, which sometimes form indistinct nodes at the angles. Septa strong; sometimes distant from each other; at other times quite closely arranged. Mural pores minute, comparatively distant, a single series on each face of the tube.

This species is very variable in its mode of growth, sometimes occurring in branching forms, with the cell tubes commencing at the centre and gradually curving upward and outward to the surface; others are in hemispherical masses, with a flat base, the tubes radiating from the base to the surface; increasing by interstitial or lateral additions; sometimes in masses formed of successive layers, as if by interruptions in growth. It is also found encrusting crinoid stems and other objects, especially the basal portion of *Lepadocrinus*, occurring sometimes in layers of not more than 2 mm. in thickness.

It differs from *F. proximus* in its smaller cell tubes, the thinner walls and the frequent maculæ of large cells.

Formation and localities. Lower Helderberg group, Schoharie, and near Clarksville, N. Y.

Favosites proximus.

PLATE VII, FIGS. 13-15.

Favosites proximus, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 147. 1880.
" " " Report of State Geologist for 1882. Expl. pl. 7, figs. 13-15. 1883.

Corallum forming irregular masses, frequently by the superimposition of successive layers of growth. Cell tubes pentagonal or hexagonal; length from 2 to 10 mm.; diameter from .40 to .50 mm.; walls comparatively strong. Septa of about the same thickness as the cell walls, five or more in the space of 5 mm. Mural pores minute, occurring in one or two series on each face of the cell tube.

This species in general appearance is very similar to *F. sphæricus*, but may be distinguished from that species by its larger cells, thicker and smoother cell walls and the absence of maculæ of larger cells.

Formation and locality. Lower Helderberg group, Schoharie, N. Y.

ALVEOLITES, Lamarck. 1801.

Alveolites explanatus.

PLATE XIII, FIGS. 15, 16.

Alveolites explanatus, Hall. Report of State Geologist for 1883. Expl. pl. 13, figs. 15, 16.

Corallum growing as irregular incrusting expansions upon other organisms. Cell tubes small, less than 1 mm. in longest diameter, compressed and rising very obliquely to the surface; marked by obscure longitudinal striæ.

The specimens of this species which have been observed, occur in explanate masses on Favosites and Stromatopora, and seldom weathered so as to exhibit their exterior structure, but are usually shown in sections and polished cuttings. It presents very little detail of form or structure, and is of little interest except as being the only species of the genus noticed from the rocks of this age.

Formation and localities. In the lower Pentamerus limestone of the Lower Helderberg group, near Cedarville, Herkimer county; near Clarksville, Albany county, and at Schoharie, N. Y.

CHÆTETES, Fischer. 1837.

Chætetes colliculatus.

PLATE VIII, FIGS. 1–4.

Chætetes colliculatus, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 148. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 8, figs. 1–4. 1883.

Corallum hemispheric. Base generally flat; sometimes very concave, in which case the corallum consists of a depressed conical mass. Base covered by a strongly wrinkled epitheca. Cells polygonal, from quadrangular to hexagonal, nearly equal in size; diameter at the aperture about .50 mm.; walls thin and slightly undulating. Septa very thin, distant, five in the space of 5 mm. Surface marked by monticulæ about 2 mm. in height, the centers of which are distant from each other 5 mm., with cells the same size as the others.

The largest specimen observed has a diameter at the base of 35 mm., and a height of 25 mm.

This species may be distinguished from *C. monticulatus* by the larger size of the cells.

Formation and locality. Lower Helderberg group, Schoharie, N. Y.

Chætetes monticulatus.

PLATE VIII, FIGS. 5-7.

Chaetetes monticulatus, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 148. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 8, figs. 5-7. 1883.

Corallum forming spheroidal masses. Cell tubes polygonal, generally pentagonal or hexagonal; diameter from .25 to .35 mm.; walls thin, strongly corrugated. Septa slightly thinner than the cell walls, occurring at irregular intervals, varying from .33 to 8 mm. or more. On the surface are monticulæ, arranged in intersecting rows, the centers of which are distant from each other about 5 mm., with cells of the same size as on other parts of the surface.

This species resembles *C. colliculatus*, but may be distinguished from that species by its spheroidal form, and its smaller cell tubes.

Formation and locality. Lower Helderberg group, Schoharie, N. Y.

Note. — The two preceding species possess the features usually recognized as characteristic of the genus Chætetes, but which nevertheless appear to be common to the genus Monotrypa of Ulrich. In the present state of our knowledge I propose to leave them, as originally described, under the genus Chætetes.

Chætetes (Monotrypella) arbusculus.

PLATE IX, FIGS. 1-3, 6-8, (4, 5)?

Chaetetes fruticosus, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 148. 1879.
Not *Chætetes fruticosus*, Hall. Illustrations of Devonian Fossils, pl. 38, figs. 1-5. 1876.
Chaetetes fruticosus, Hall. Report of State Geologist for 1882. Expl. pl. 9, figs. 1-8. 1883.

Corallum fruticose, several stems arising from a single base; bifurcations frequent; branches generally diverging at an angle of about forty-five degrees; diameter from 2 to 3 mm. Cell tubes polygonal, arising from the center of the branch and very gradually diverging to the surface; walls thin; exterior smooth or slightly wrinkled transversely. Length of tubules

reaching 5 mm.; diameter .20 mm.; apertures slightly oblique to the surface. Septa thin, infrequent.

This species may be distinguished from *C. abruptus* [plate ix, figs. 9–11], by its fruticose appearance, its more slender growth, (which character appears to be constant), the thinner and more infrequent septa, but especially by the manner in which the cell tubes approach the surface.

Formation and locality. Lower Helderberg group, Schoharie, N. Y.

Chætetes (Monotrypella) abruptus.

PLATE IX, FIGS. 9-11.

Chætetes abruptus, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 148. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 9, figs. 9-11. 1883.

Corallum ramose, solid; branches frequent, diverging at an angle of about forty-five degrees. Cells tubular, polygonal; arising from the center of the branch and very gradually diverging until about 2 mm. from the surface, when they abruptly turn outward. At this point they are generally constricted, and the cell walls, previously very thin, become much thicker; length reaching 6 mm.; diameter at the surface from .20 to .25 mm.; frequently spinulose at the angles. Septa rare or entirely wanting until after the abrupt turning of the cell tubes, when they are numerous.

This species, when a longitudinal section can be seen, is easily recognized by the abrupt turning of the cell tubes to the surface, also in the constriction and thickening of the walls at this point, features in which it differs from any other species of this formation.

Formation and locality. Lower Helderberg group, Schoharie, N. Y.

Chætetes (Monotrypella) densus.

PLATE X, FIGS. 11-13.

Trematopora densa, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 105. 1874.
Trematopora (Chætetes) densa, Hall. Thirty-second Rept N. Y. State Mus. Nat. Hist., p. 150. 1879.
" " " " Report of State Geologist for 1882. Expl. pl. 10, figs. 11-13. 1883.

Corallum ramose, solid; diameter of branches from 3 to 4 mm. Cells tubular, polygonal, arising from the center of the branch and quite regularly curving to the surface; diameter at the apertures somewhat variable, but generally about .33 mm.; walls thin, sometimes becoming much thickened at the surface, constricting the apertures; frequently spinulose at the angles. Septa thin, occurring only near the surface. Surface marked by occasional maculæ, where the cells are larger than on other portions, having a diameter of .50 mm.

Formation and localities. In the shaly limestone of the Lower Helderberg group, at Catskill creek, and near Clarksville, N. Y.

PTYCHONEMA, n. g.

Ptychonema, n. s. g.

Distinguished by the strong corrugations of the cell walls and absence of septa.

Chætetes (Ptychonema) tabulatus.

PLATE IX, FIGS. 12-15.

Chætetes tabulatus, Hall. Illustrations of Devonian Fossils, Corals: Pl. 37, figs. 16-19. 1876.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 149. 1879.
" ? " " Report of State Geologist for 1882. Expl. pl. 9, figs. 12-15. 1883.

Corallum forming spheroidal or hemispheric masses. Diameter of the largest specimen observed 45 mm. Cell tubes polygonal, arising from the center of the base and increasing by interstitial additions. Diameter at the aperture about .50 mm.; walls thin, very strongly and regularly corrugated, the corrugations forming nodes at the angles; about fifteen corrugations in the space of 5 mm. Septa, so far as observed, wanting.

Formation and locality. Probably from the Upper Helderberg group, Schoharie, N. Y.

PTYCHONEMA HELDERBERGIÆ.

PLATE IX, FIGS. 16, 17.

Chætetes Helderbergiæ, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 110. 1874.
Not *Favosites Helderbergiæ*, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 111. 1874.
Favosites inexpectans, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 146. 1880.
Chætetes Helderbergiæ, " Report of State Geologist for 1882. Expl. pl. 9, figs. 16, 17. 1883.

CORALLUM ramose; diameter of the branches 10 mm. Cell tubes polygonal, arising from the center of the branch and very gradually diverging until within 1 mm. from the surface when they abruptly turn outward, the apertures being parallel with the surface; length reaching 15 mm.; diameter of apertures of larger cells from .50 to .65 mm. There are numerous intercalations of young cells whose apertures have a diameter of from .20 to .25 mm. Exterior of cell walls strongly and regularly corrugated; about fifteen in the space of 5 mm. The corrugations sometimes form nodes at the angles of the walls. Septa thin, distant in the lower portion of the tube, becoming more numerous near the surface.

Formation and localities. In the shaly limestone of the Lower Helderberg group, at Catskill creek, near Clarksville, and at Schoharie, N. Y.

TREMATOPORA, HALL. 1852.

TREMATOPORA? (TREMATELLA?) CORTICOSA.

PLATE X, FIGS. 1-10; PLATE XIII, FIG. 4; AND PLATE XXIII, FIG. 20.

Trematopora corticosa, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 115. 1874.
Chætetes corticosa, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 149. 1880.
Trematopora (Chætetes) corticosa, HALL. Report of State Geologist for 1882. Expl. pl. 10, figs. 1-10; pl. 13, fig. 4. 1883.

CORALLUM ramose, solid; branches sometimes frequent; at other times distant; often diverging at an angle of ninety degrees; diameter from 4 to 5 mm. Cells tubular, polygonal; arising from the center of the branch, gradually diverging until within a short distance of the surface, when they abruptly turn outward; diameter .25 mm. Walls thin, sometimes transversely wrinkled. Septa comparatively strong, distant from each other about .50

mm. Through the thickening of the cell walls near the surface the apertures are constricted and oval in outline. The inter-apertural spaces are strongly elevated, frequently forming irregular ridges, the surface then resembling, in miniature, the roughened bark of a tree.

This species is easily recognized by its polygonal cell tubes, oval apertures, its peculiarly roughened surface and the widely diverging branches.

Formation and locality. In the shaly limestone of the Lower Helderberg group, near Clarksville, N. Y.

NOTE.—This form does not fully represent the characters of TREMATELLA, but I prefer to leave it for the present under that designation.

ORTHOPORA, n. s. g.

ZOARIUM ramose, cell apertures arranged in parallel, longitudinal rows. Intercellular space solid, or occupied near the surface, by minute tubuli, destitute of septa.

Externally very similar to *Rhombopora*, but differing internally. These forms differ from *Trematella* in the regular arrangement of the cell apertures.

TREMATOPORA (ORTHOPORA) REGULARIS.

PLATE XI, FIGS. 1-8; PLATE XIII, FIG. 1-3; AND PLATE XXIII, FIG. 1.

Trematopora regularis, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 106. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 151. 1879.
In part *Trematopora regularis*, HALL. Report of State Geologist for 1882. Expl. pl. 11, figs. 1-8; pl. 13, figs. 1-3. 1883.

ZOARIUM ramose, solid; bifurcations infrequent; branches widely diverging, slender, the diameter seldom exceeding 1 mm. Branches having a diameter of only .50 mm. are not uncommon. Cells tubular, arising from the center of the branch and gradually diverging till within a short distance of the surface, when they turn quite abruptly outward. Near the center of the branch the cells are in contact and frequently sub-polygonal from mutual pressure, separating as they approach the surface. Apertures elongate-oval, length from .15 to .18 mm., width from one-fourth to one-half the length; arranged in longitudinal parallel rows, fifteen in the space of five mm.; from

ten to twelve rows on a branch, separated by prominent serrated ridges, which are frequently wider than the cell apertures, often obscuring them. Twelve serrations in the space of one mm.

This species is very common, and when well preserved will be easily recognized, but when so worn or macerated that the longitudinal ridges are obsolete it closely resembles *T. rhombifera*.

Formation and locality. In the shaly limestone of the Lower Helderberg group, near Clarksville, N. Y.

Trematopora (Orthopora) ovatipora.

PLATE XI, FIGS 9–11; AND PLATE XXIII, FIG. 5.

Trematopora ovatipora, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 151. 1879.
" ? " " Report of State Geologist for 1882. Expl. pl. 11, figs. 9–11. 1883.

Zoarium ramose, solid, very slender; diameter .50 mm. Cell apertures ovate, length .30 mm., width about one-third the length; disposed in longitudinal parallel rows: margins slightly elevated, and granulose; at the posterior margin of each cell aperture a minute spine; space between adjacent apertures about .15 mm. Five or six rows on each branch, separated by a slightly elevated granulose ridge.

This species may be distinguished from *T. regularis* by its larger, ovate apertures and the number of rows on a branch.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Trematopora (Orthopora) canaliculata.

PLATE XI, FIG. 12; AND PLATE XXIII, FIG. 9

Trematopora canaliculata, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 151. 1879.
" ? " " Report of State Geologist for 1882. Expl. pl. 11, fig. 12. 1883.

Zoarium ramose, solid, diameter of branches .90 mm. Cell apertures oval, length .25 mm., width from one-half to two-thirds the length; disposed in longitudinal parallel rows, alternating: margins distinctly and equally elevated, slightly constricting the opening, sometimes having on one side a minute denticula-

tion. At each end of the aperture and frequently on other portions of the margin there is a short obtuse spinule. Interapertural space concave.

This species, in its arrangement of cell apertures, is very similar to *T. rhombifera*, but differs from that species in having the apertures much more distinctly oval, and more widely separated, and in the concave interapertural space.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Trematopora (Orthopora) rhombifera.

PLATE XI, FIGS. 15, 17-20; AND PLATE XXIII, FIGS. 11, 12.

Trematopora rhombifera, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 103. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 152. 1879.
In part *Trematopora rhombifera*, Hall. Report of State Geologist for 1882. Expl. pl. 11, figs. 15–20. 1883.

Zoarium ramose, solid, diameter of branches from .50 to 2 mm. Cells tubular, arising from the center of the branch, rapidly diverging till within a short distance of the surface when they turn more abruptly outward. Apertures oval or, occasionally, sub-rhomboidal, length .20 mm., width .12 mm.; very closely disposed in quincunx order: margins thin, very slightly elevated, granulose; granules often obsolete. Interapertural space generally elevated above the apertures, though sometimes flat; in well preserved specimens nodose or granulose, occasionally so set with minute spines that the apertures are obscured.

This species, in some points, is closely allied to *T. regularis*, with which it is often associated, but differs materially in the arrangement of the cell apertures, that species having the apertures in longitudinal lines with a prominent ridge between, while in this species they are always spirally arranged. In worn specimens the difference is less distinctly seen.

Formation and localities. In the shaly limestone of the Lower Helderberg group, near Clarksville, Albany county, and at Schoharie, N. Y.

Trematopora (Orthopora) parallela.

PLATE XI, FIGS. 13, 14; AND PLATE XXIII, FIGS. 7, 8.

Trematopora parallela, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 152. 1879.
" ? " " Report of State Geologist for 1882. Expl. pl. 11, figs. 13, 14. 1883.

Zoarium ramose, solid; bifurcations infrequent; diameter of branches 1 mm. Cells tubular, arising from the center of the branch, gradually curving to the surface. Apertures oval, length .20 mm., width from .12 to .15 mm.: margins equally elevated; arranged in quincunx, forming longitudinal parallel rows. Each aperture has some portion of its margin nearly or quite in contact with four other apertures, the margins thus forming a continuous elevation, which, especially when thickened by silicification, resembles a ridge separating the rows of apertures. At each point of contact there is a small spine.

This species closely resembles some forms of *T. regularis*, but the peculiar arrangement of apertures will be sufficient to distinguish it.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

DIAMESOPORA, Hall. 1852.

Zoarium ramose, hollow, inner surface consisting of an epitheca. Intercellular space solid.

These forms differ from *Trematella* in having hollow branches.

Diamesopora constricta.

PLATE X, FIGS. 14–19; AND PLATE XXIII A, FIG. 7.

Trematopora constricta, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 104. 1874.
Trematopora? " " Thirty-second Rept. N. Y. State Mus. Nat. Hist. p. 150. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 10, figs. 14–19. 1883.

Zoarium ramose; branches frequent, hollow; diameter from 2 to 4 mm. Thickness of the bryozoum .33 mm.; inner surface covered by an epitheca; marked by strong concentric undulations of growth and fine striations; fine longi-

tudinal striæ caused by the recumbent portion of the cells. Cells tubular, sub-cylindrical, arising from the epitheca and for about one-half their length parallel with it, then abruptly turning outward and opening obliquely to the surface. Apertures oval, length .25 mm., width slightly less; more or less regularly alternating and imbricating. Posterior margin strongly elevated, projecting over and concealing a portion of the opening; sometimes with two minute denticulations.

There are frequent maculæ destitute of cell apertures; the apertures immediately adjacent to these being larger than the others and radiating from the maculæ.

This is a very common species and can be easily recognized by the strong projecting lip of the cell apertures, the prominent maculæ and the arrangement of the cells.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Diamesopora dispersa.

PLATE X, FIGS. 20, 21.

Trematopora dispersa, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 150. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 10, figs. 20, 21. 1883.

Zoarium ramose; branches hollow, diameter 3 mm. Thickness of the bryozoum .75 mm. Inner surface covered by a transversely wrinkled epitheca. Cells tubular, opening slightly oblique to the surface. Apertures circular or oval, diameter .30 mm., irregularly disposed, sometimes forming transverse rows: margins thick, distinctly and sometimes, equally elevated; at other times the lower portion is the more strongly elevated, giving to the aperture a sub-triangular appearance.

There are occasional maculæ destitute of cell apertures, the cells, immediately adjacent, radiating from them.

This species differs from *D. constricta* in the cell apertures being less oblique and more irregularly arranged.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

CALLOPORA, Hall. 1852.

Callopora oppleta, n. sp.

PLATE XI, FIGS. 23, 24.

In part *Callopora macropora*, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 152. 1880.
" *Callopora macropora*, " Report of State Geologist for 1882. Expl. pl. 11, figs. 23-29. 1883.

Zoarium ramose, solid, diameter of branches 3 mm.; bifurcations frequent. Cell apertures circular, diameter .33 mm., irregularly disposed, frequently in contact: margins strong, equally elevated. Mesopores minute, not more than one series between adjacent apertures.

Formation and locality. Lower Helderberg group, near Clarksville, Albany county, N. Y.

Callopora cellulosa.

PLATE XII, FIGS. 1-9; PLATE XIII, FIG. 9; AND PLATE XXIII A, FIG. 6.

Callopora cellulosa, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 154. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 12, figs. 7-9; pl. 13, fig. 9. 1883.

Zoarium ramose, solid, diameter of branches from 3 to 5 mm.; bifurcations frequent. Cells tubular, often sub-polygonal from mutual pressure; arising from the center of the branch, gradually diverging till within one mm. of the surface, when they turn abruptly outward; walls, except near the surface, very thin. Septa thin, distant. Apertures circular or broadly oval, diameter from .20 to .25 mm.; irregularly disposed, frequently in contact: margins strong, distinctly and equally elevated. Mesopores minute, angular: margins of the same height as those of the apertures. Intercellular space septate for a short distance below the surface.

The surface of this species is variable in appearance; very frequently the margins of the apertures and mesopores are smooth; at other times the margins of the apertures have comparatively strong nodes, the mesopores being nearly or quite obscured; in others the margins of both the apertures and mesopores are ornamented with minute spines, which often are so numerous as to entirely obscure all other features of the surface.

This species closely resembles *C. venusta* of this formation, but may be distinguished as follows: The branches of that species are hollow, the cell apertures are slightly larger, more decidedly oval, often regularly arranged in quincunx over a large portion of the specimen; but there are occasionally specimens which could not be separated by the surface characters alone.

Formation and locality. In the shaly limestone of the Lower Helderberg group, near Clarksville, N. Y.

CALLOPORA PERELEGANS.

PLATE XII, FIGS. 10-17; AND PLATE XXIII A, FIG. 14.

Callopora perelegans, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 102. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 154. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 12, figs. 10-17. 1883.

ZOARIUM fruticose, several stems arising from a common base; bifurcations very frequent. Branches solid, diameter from 2 to 5 mm., generally from 3 to 4 mm. Cells tubular, arising from the center of the branch, gradually diverging till within one mm. of the surface, when they abruptly turn outward; walls very thin. Septa infrequent or entirely wanting. Apertures circular or sub-polygonal from pressure, diameter .50 mm.; irregularly disposed, sometimes in contact; at other times distant one mm. or more: margins thin, distinctly and equally elevated. Mesopores frequently longer than wide, length sometimes four times the width: margins equal in thickness and height to those of the apertures. Intercellular space occupied by septate tubuli of varying lengths, occasionally extending to the center of the branch. Septa very thin and frequent, from eight to twelve in the space of one mm.

This species closely resembles *C. elegantula* of the Niagara group, and may be only a variety of that species. Externally the mesopores of *C. elegantula* are much smaller, and the width is usually about equal to the length. Internally the cell-tubes have numerous septa nearly equal in thickness to the cell-walls, frequently four in the space of one mm., while in this species the septæ are very infrequent or entirely wanting.

Formation and locality. In the shaly limestone of the Lower Helderberg group, near Clarksville, Albany county, N. Y.

Cœlocaulis, n. s. g.

Branching forms having the structure of Callopora, but growing as hollow stems, the thin expansion lined with a striated epitheca.

Callopora (Cœlocaulis) venusta.

PLATE XII, FIGS. 20–24; AND PLATE XXIII A, FIGS. 1–3, 4? 5.

Callopora venusta, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 101. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 155. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 12, figs. 20–24. 1883.

Zoarium ramose, hollow; diameter of branches from 3 to 5 mm.; bifurcations frequent. Thickness of tissue from .25 to 1 mm Inner surface a thin epitheca with transverse wrinkles and fine longitudinal striations caused by the recumbent portions of the cells. Cells tubular, arising from the epitheca and parallel with it for a short distance, then turning abruptly outward. Apertures oval, length .33 mm., width .20 mm.; sometimes irregularly disposed, but generally in more or less regular quincunx order; frequently in contact: margins thin, except when thickened by silification; distinctly elevated. Mesopores minute, polygonal; generally only a single series between adjacent apertures: margins thinner and less elevated than those of the apertures. The margins of the apertures and mesopores are usually smooth, but are sometimes ornamented by numerous minute spinules. Surface marked by distant, slightly elevated monticules, upon which the apertures are larger than on other portions. Intercellular space sometimes septate, at other times apparently vesicular

This form is distinguished from *C. cellulosa* by its hollow branches, and its larger and more regularly disposed cells.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Callopora (Cœlocaulis) mediopora, n. sp.

PLATE XIV, FIG. 18; AND PLATE XXIII A, FIGS. 11–13.

In part *Callopora parasitica*. Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 157. 1879.
" " " " Report of State Geologist for 1882. Expl. pl. 14, figs. 13–18. 1883.

Zoarium ramose, branches hollow, often flattened; thickness .75 mm. Cells tubular, oblique to the surface. Cell apertures oval, sub-triangular or trilobate,

length from .33 to .50 mm., width from one-half to three-fourths the length; closely and irregularly disposed. Anterior margin thin, slightly elevated, gradually growing more prominent, and at the posterior end strongly elevated, oblique, denticulated, constricting that portion of the aperture. Mesopores variable in size, some having a diameter of only .15 mm., while others are nearly as large at the cell apertures; margins very thin; height equal to that of the anterior margin of the cell aperture.

I had formerly considered this species a form of *Fistulipora parasitica*, but its apparent parasitic character is due to the flattening of the larger branches and their attachment to other bodies.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Callotrypa, n. s. g.

The species resemble Callopora in their general characters, but differ in having a solid intercellular space, or which is sometimes occupied by minute tubuli, destitute of septa; while in that genus the intercellular space is vesicular or occupied by septate tubuli.

Callopora (Callotrypa) macropora.

PLATE XI, FIGS. 25-29; AND PLATE XXIII, FIGS. 15-19.

Callopora macropora, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 101. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 152. 1879.
In part *Callopora macropora*, Hall. Report of State Geologist for 1882. Expl. pl. 11, figs. 23-29. 1883.

Zoarium ramose, solid, diameter of branches from 1 to 2 mm.; bifurcations frequent; branches diverging from forty-five to ninety degrees. Cells tubular, arising from the center of the branch and regularly curving to the surface, increasing by interstitial addition; in contact for the greater portion of their length. Walls thin, becoming thicker near the surface and slightly constricting the cell tube. Apertures oval or polygonal from mutual pressure, length on different specimens from .33 to .50 mm., width from one-half to two-thirds the length; irregularly disposed, generally some portion of each aperture in

contact with adjacent apertures: margins distinctly and equally elevated, occasionally nodose. Mesopores minute: margins of the same height as those of the apertures. No internal vesicular structure visible.

Formation and localities. In the shaly limestone of the Lower Helderberg group, at Catskill, Greene county; near Clarksville, and at Schoharie, N. Y.

Callopora (Callotrypa) macropora, var. signata.

PLATE XI, FIGS. 30, 31.

Trematopora signata, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 104. 1874.
Callopora macropora, var. *signata*, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 153. 1879.
" " " " Report of State Geologist for 1882. Expl. pl. 11, figs. 30, 31. 1883.

This variety differs from the usual form of *C. macropora* in the more distinctly polygonal cell apertures, and in having but very few intercellular pits.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Callopora (Callotrypa) heteropora.

PLATE XI, FIGS. 32-34; PLATE XIII, FIGS. 5-8; AND PLATE XXIII, FIG. 3.

Callopora heteropora, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 102. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 153. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 11, figs. 32-34; pl. 13, figs. 5-8. 1883.

Zoarium ramose, solid, diameter of branches from 1 to 1.50 mm.; bifurcations distant; branches diverging at an angle of forty-five degrees. Cells tubular, arising from the center of the branch and very gradually diverging till within a short distance of the surface, when they turn abruptly outward; at this point the walls, previously very thin, become thicker, slightly constricting the cell. For the greater portion of their length the cells are in contact and subangular from mutual pressure. Apertures oval, length .20 mm., width about two-thirds the length; irregularly disposed: margins equally elevated. Mesopores minute, elongate, angular, so arranged that their margins often

resemble fine striations. The margins of the apertures and intermediate pits are frequently spinulose.

Formation and locality. In the shaly limestone of the Lower Helderberg group, near Clarksville, Albany county, N. Y.

Callopora (Callotrypa) unispina.

PLATE XI, FIGS 35-37.

Callopora unispina, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 102. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 153. 1879.
In part *Callopora unispina*, Hall. Report of State Geologist for 1882. Expl. pl. 11, figs. 35–41. 1883.

Zoarium ramose, solid, diameter from 1.50 to 2 mm. Cells tubular, arising from the center of the branch and regularly curving to the surface. Apertures broadly oval, length .17 mm., width about three-fourths the length; occasionally circular, closely and irregularly disposed: margins moderately strong, equally elevated. At the base of each aperture is a, comparatively, very prominent spinule. Mesopores minute, elongate, angular, so disposed that the margins give to the surface a finely striated appearance. No vesicular intercellular space.

This species, when well preserved, will be easily recognized by the prominent spinule at the base of each aperture; when worn or macerated it very closely resembles *C. heteropora*.

Formation and localities. In the shaly limestone of the Lower Helderberg group, on Catskill creek, Greene county, and near Clarksville, Albany county, N. Y.

Callopora (Callotrypa) striata, n. sp.

PLATE XI, FIGS. 38-41; AND PLATE XXIII, FIGS. 13, 14.

In part *Callopora unispina*. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 153. 1880.
" " " Report of State Geologist for 1882. Expl. pl. 11, figs. 35–41. 1883.

Zoarium ramose, solid, diameter of branches 1 mm.; bifurcations infrequent. Cell apertures oval, length .33 mm., width about one-half the length; irregularly disposed, sometimes in contact; at other times distant .33 mm. or more: margins moderately strong, distinctly and equally elevated. At

the base of each aperture there is usually a spinule. Mesopores minute, elongate, the length often being from two to three times the width, so disposed that the margins give to the surface a finely striated appearance.

This species may be distinguished from *C. unispina* by the elongate cell apertures and mesopores, and the striated appearance of the surface.

Formation and localities. In the shaly limestone of the Lower Helderberg group, on Catskill creek, Greene county, and near Clarksville, Albany county, N. Y.

Callopora (Callotrypa) oculifera.

PLATE XIII, FIG 10; AND PLATE XXIII, FIG. 6.

Callopora oculifera, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 155. 1879.
" " " Report of State Geologist for 1882. Expl pl. 13, fig. 10.

Zoarium ramose, solid, diameter of branches 1 mm. Cell apertures broadly oval, length .33 mm., width about three-fourths the length; more or less regularly disposed in longitudinal rows; seventeen in the space of five mm.: margins thin, distinctly elevated. Mesopores minute, angular: margins equal in height to those of the cell apertures.

This species may be distinguished by the large broadly oval apertures, arranged in longitudinal lines, and the minute mesopores.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

FISTULIPORA, McCoy. 1849.

Fistulipora ponderosa.

PLATE XIV, FIGS. 9-12; AND PLATE XXIII a, FIGS. 8-10.

Callopora ponderosa, Hall. Twenty-sixth Rep. N. Y. State Mus. Nat. Hist., p. 103. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 156. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 14, figs. 9-12. 1883.

Zoarium consisting of explanate fronds (?) of irregular, contorted growth, generally massive from the superimposition of successive layers of growth. Thickness of frond (?) varying from 1 to 5 mm., or more. Under surface

consisting of a strongly wrinkled epitheca. Cells tubular, arising from and for a short distance oblique to the epitheca, then turning abruptly upward; walls very thin. Septa infrequent or entirely wanting. Apertures circular, diameter slightly more than .25 mm.; irregularly, very closely disposed, frequently in contact: margins thin, slightly elevated, ornamented with from one to three very prominent spines. Mesopores very minute: margins thinner than those of the apertures, but of the same height. Intercellular space vesiculose; vesicles irregularly arranged, comparatively very large, frequently from .25 to .33 mm. in diameter.

This species may be distinguished by its closely arranged circular cell apertures with spiniferous margins, in which characters it varies from any other species of this formation.

Formation and locality. In the shaly limestone of the Lower Helderberg group, near Schoharie, N. Y.

Fistulipora parasitica.

PLATE XIV, FIGS. 13, 14; AND PLATE XXIII, FIG. 4.

In part *Callopora parasitica*, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 157. 1879.
" " " " Report of State Geologist for 1882. Expl. pl. 14, figs. 13–18. 1883.

Zoarium explanate, or ramose, with hollow branches, free or encrusting other bodies. Thickness .75 mm.; inner, or under surface consisting of a thin, concentrically wrinkled epitheca. Cells tubular; apertures oval or slightly polygonal from mutual pressure, length from .25 to .33 mm., width from .17 to .25 mm.; very irregularly disposed, sometimes in contact, at other times distant .50 mm. or more: margins thin, slightly and equally elevated; frequently with one or more minute spinules. Mesopores variable in size, some having a diameter of only .10 mm., while others are equal to the cell apertures: margins of the same thickness and height as those of the cell apertures. Intercellular space vesiculose; vesicles sometimes regularly arranged, appearing as septate tubuli; at other times irregular, especially near the base of the cell tubes.

The characteristics of this species are the very irregular arrangement of the cell apertures, and the large and numerous mesopores. The ramose forms may be distinguished from *Callopora cellulosa* by the much larger and more numerous mesopores and the hollow branches; from *Callopora venusta* by the smaller and more distant cell apertures and the larger and more numerous mesopores.

Formation and locality In the shaly limestone of the Lower Helderberg group, near Clarksville, N. Y.

Fistulipora triloba, n. sp.

NOT FIGURED.

Zoarium generally explanate, sometimes ramose, branches hollow, of very irregular growth, undulating or contorted; often massive from the superimposition of successive layers of growth. Thickness of fronds (?) varying from 1 to 5 mm. Under surface consisting of a thin, concentrically wrinkled epitheca. Cells tubular, arising from the epitheca, and almost immediately assuming an erect position, and thus continuing to the surface; walls very thin. Septa infrequent or entirely wanting. Apertures sub-triangular or trilobate, length .30 mm., greatest width .25 mm., or slightly more; irregularly disposed; space between adjacent apertures less than the length of an aperture: margins elevated, sometimes equally, at other times the posterior is the most strongly elevated. At a little less than half the distance from the posterior end there are two dentations, which give to the apertures the trilobate form, and which in the course of growth form two fine striations on the interior of the cell-wall. Mesopores minute, from one to three series between adjacent apertures. Surface marked by maculæ destitute of cell apertures, the centers of which are distant from each other about five mm.; the apertures immediately adjacent are larger than the others and radiate from the maculæ. Intercellular space occupied by septate tubuli, except near the base of the cells, where the structure is irregularly vesicular. From eight to ten septa in the space of one mm. On one specimen the margins of the apertures are very much elevated, thickened and in many cases closed.

Formation and locality. Lower Helderberg group, near Schoharie, N. Y.

LICHENALIA, HALL. 1852.

LICHENALIA CRASSA.

PLATE XI, FIGS. 21, 22.

Trematopora crassa, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 152. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 11, figs. 21, 22. 1883.
Not *Fistulipora crassa*, ROMINGER.

ZOARIUM hollow, or explanate. Thickness of specimens observed about 1 mm. Cell apertures circular, diameter .25 mm., quite regularly separated from each other by a space equal to half the diameter of an aperture, forming somewhat irregular intersecting rows. Surface marked by numerous small acellular maculæ, the centers of which are distant from each other two or three mm. Interapertural space smooth. Intercellular space occupied by minute septate tubuli, except near the base of the cells, where the space is occupied by irregularly arranged vesicles; from one to three series of tubuli between adjacent cells; from eight to ten septa in the space of one mm.

This species may be distinguished by its closely arranged cell apertures, absence of mesopores, and the numerous acellular maculæ. It resembles specimens of *Fistulipora ponderosa* which have been worn or macerated, but that species has mesopores and larger cell apertures, and is without acellular maculæ.

Formation and locality. Lower Helderberg group, Schoharie, N. Y.

LICHENALIA MACULOSA.

PLATE XIV, FIGS. 1-8.

Trematopora ponderosa, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 126. 1874.
" *maculosa*, " Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 106. 1874
Callopora maculosa, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist, p. 156. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 14, figs. 1-8. 1883.

ZOARIUM explanate, generally of irregular growth, frequently much contorted; often massive from the superimposition of successive layers of growth. Thick- of bryozoum varying from 1 to 8 mm. Under surface consisting of a strongly wrinkled epitheca. Cells tubular, sub-cylindrical, arising from the epitheca at right angles to the surface; walls moderately thick. Septa thin and

infrequent. Apertures broadly oval, sometimes nearly circular, length .33 mm., width .25 mm.; irregularly disposed, frequently in contact. Anterior margins thin, very slightly elevated; posterior strongly elevated, oblique; sometimes with two slight denticulations, which give to the aperture a subtrilobate form. Surface marked by maculæ, the centers of which are distant from each other about six mm.; the apertures immediately adjacent are larger than the others, more oblique and radiating from the maculæ. Interapertural space smooth or vesiculose. Intercellular space vesicular; vesicles irregularly arranged, many of them, comparatively, very large.

The surface of this species presents a variable appearance, according to the degree of weathering.

Formation and localities. In the shaly limestone of the Lower Helderberg group, at Catskill, and near Clarksville, N. Y.

LICHENALIA TORTA.

PLATE XV, FIGS. 1-5, 7.

Lichenalia torta, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 157. 1879.
In part *Lichenalia torta*, HALL. Report of State Geologist for 1882. Expl. pl. 15, figs. 1-7.

ZOARIUM consisting of lamellate expansions; sometimes flat, at other times more or less involved and contorted. Under surface a thin epitheca marked by concentric wrinkles and striæ, with fine radiating striæ. When the celliliferous tissue of the bryozoum has been removed, the radiating striæ on the upper surface of the epitheca are very sharp and prominent, and at their junction with the concentric striæ form minute nodes. Cell apertures broadly oval or circular, sometimes sub-triangular or trilobate, diameter .30 mm.; space between adjacent apertures equal to, or less than, the diameter of an aperture. Anterior margin slightly elevated, posterior side strongly elevated, with two slight denticulations. Surface with slightly elevated monticules.

Formation and localities. Lower Helderberg group, near Clarksville, and at Schoharie, N. Y.

Lichenalia serialis, n. sp.

PLATE XIII, FIGS. 17, 18; AND PLATE XV, FIG. 6.

In part *Lichenalia torta*. Hall. Thirty-second Rept. N. Y. State Mus Nat. Hist., p. 157. 1880.
Lichenalia torta (*tortuosa* in error). Report of State Geologist for 1882. Expl. pl. 13, figs. 17, 18; pl. 15, fig. 6. 1883.

Zoarium explanate, thin. Cells tubular, very oblique, alternating and imbricating. Apertures circular, diameter .40 mm.; generally regularly disposed: margins strong, the posterior portion elevated slightly more than the anterior. Interapertural space marked by short interrupted striations. Maculæ destitute of cell apertures, distant from each other 6 mm.; apertures adjacent to them larger than on other portions of the frond.

This species may be distinguished by the large, circular cell apertures, and their regular arrangement.

Formation and locality. Lower Helderberg group, near Clarksville, Albany county, N. Y.

Lichenalia distans.

PLATE XV, FIGS. 8, 9.

Lichenalia distans, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 157. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 15, figs. 8, 9. 1883.

Zoarium consisting of lamellate expansions, free or encrusting. Thickness 1 mm. Cells tubular; apertures somewhat variable, usually oval or nearly circular, sometimes sub-quadrangular, and occasionally sub-triangular, length from .35 to .44 mm., width generally a little less than the length; irregularly and very closely disposed: margins thin, not prominent, except at the posterior end, where they are strongly and abruptly elevated. Mesopores variable in size, from one to two ranges between adjacent apertures: margins thin and slightly raised, rendering the mesopores obscure. Intercellular space vesicular; vesicles comparatively large.

Over the greater portion of the specimen the margins of the apertures are of equal height, but this is probably due to weathering; on some portions of the zoarium they are so sharply elevated that in an oblique view they have the appearance of spines.

Formation and locality. Lower Helderberg group, Schoharie, N. Y.

CERAMOPORA, HALL. 1852.

CERAMOPORA MACULATA.

PLATE XVI, FIGS. 5-11.

Ceramopora maculata, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 106. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 159. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 16, figs. 5–11. 1883.

ZOARIUM discoidal, flattened or concave on the lower side; base attached at the center to some foreign body, frequently a fragment of a crinoid stem or a small gastropod; the remaining portion free, covered by a strongly wrinkled epitheca. Thickness of zoarium from 1 to 5 mm. Cells tubular, polygonal, arising from the epitheca, and radiating from the center, regularly curving to the surface; in the center being at right angles to the epitheca, and gradually becoming more oblique as they approach the margin. Apertures from .45 to .50 mm. in diameter, on some portions of the frond distinctly alternating and imbricating. There are slightly elevated circular monticules, the centers of which are distant about five mm., upon which the cells are slightly larger than on other portions.

This species resembles *C. imbricata* of the Niagara limestone, but differs in the less distinctly cucullate apertures, it also grows to a much larger size.

Formation and localities. Lower Helderberg group, Clarksville and Schoharie, N. Y.

CERAMOPORA LABECULOIDEA.

PLATE XVI, FIGS. 1, 2.

Ceramopora labeculoidea, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 158. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 16, figs. 1, 2. 1883.

ZOARIUM consisting of very thin, circular, lamellate expansions. Under surface a concentrically wrinkled epitheca. Cells short, tubular, alternating, imbricating and oblique to the surface; more or less regularly radiating from the center to the margin of the expansion. Apertures arched or triangular, with two minute denticulations; width .33 mm. Surface marked by acellular maculæ; the apertures immediately adjacent to these are a little larger

and more oblique than the others, and the upper portions of the cell-walls are exposed for nearly their entire length. The largest specimen observed has a diameter of about 10 mm.

This species differs from *C. maculata* (pl. xvi, figs. 5–11) in being much thinner; the cells smaller, more oblique and more decidedly alternating and imbricating.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

CERAMOPORA? PARVICELLA.

PLATE XVI, FIGS. 3, 4.

Ceramopora parvicella, HALL.	Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 158. 1879.
" " "	Report of State Geologist for 1882. Expl. pl. 16, figs. 3, 4. 1883.

ZOARIUM consisting of a foliate expansion encrusting other bodies. Cells short, tubular, rapidly enlarging in size. Apertures very oblique or rectangular to the surface; diameter .30 mm., alternating and imbricating. At irregular distances upon the surface there are maculæ, where the cells are larger and more decidedly oblique than on other parts.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

(*Ceramopora* (*Berenicea*) *maxima.*)

PLATE XVI, FIG. 12.

Ceramopora (*Berenicea*) *maxima*, HALL.	Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 109. 1874.
" " " "	Thirty-second Rept. N Y. State Mus. Nat. Hist., p. 159. 1879.
" " " "	Report of State Geologist for 1882. Expl. pl. 16, fig. 12. 1883.

A FINAL examination of the specimen originally described, and another one of similar character, still leaves the true nature and relations of the fossil in doubt. Until something more satisfactory shall be learned regarding the structure of the specimens, I prefer to drop the name from the list of determined species.

Formation and locality. In the shaly limestone of the Lower Helderberg group, at Schoharie, N. Y.

PALESCHARA, HALL. 1874.

PALESCHARA INCRUSTANS.

PLATE XVI, FIGS. 15-21.

Paleschara incrustans, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 106. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 160. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 16, figs. 15-21. 1883.

ZOARIUM foliate, very thin, incrusting other bodies; thickness from .10 to 1 mm. Cells polygonal, in contact; walls thick, sometimes elevated at the angles of the apertures into obtuse processes, which are not sufficiently long to be characterized as spines.

This species is very common upon the valves of *Spirifera perlamellosa*.

Formation and locality. In the shaly limestone of the Lower Helderberg group, near Clarksville, N. Y.

PALESCHARA RADIATA.

PLATE XVI, FIGS. 13, 14.

Paleschara (?) radiata, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 160. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 16, figs. 13, 14. 1883.

ZOARIUM consisting of a thin expansion incrusting other bodies. Cells polygonal, contiguous, oblique. Length of apertures about .40 mm., width slightly less; irregularly arranged, radiating from maculæ of slightly larger cells.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

PALESCHARA? DISSIMILIS.

PLATE XV, FIGS. 10-13.

Lichenalia dissimilis, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 158. 1880.
" " " Report of State Geologist for 1882. Expl. pl. 15, figs. 10-13. 1883.

ZOARIUM consisting of large, explanate fronds, irregularly undulating; thickness from .50 to 3 mm. Cell apertures polygonal, contiguous, length from .80 to 1 mm., width slightly less; variable in form, sometimes arched and

sub-imbricating; at other times presenting a reticulated appearance. Margins of the cell apertures frequently bearing short spinules on the angles.

This species, in its cell apertures, is very similar to ALVEOLITES, and its true generic relations are still undetermined.

Formation and locality. Lower Helderberg group, Schoharie, N. Y.

PALESCHARA? TENUIS, n. sp.

ZOARIUM incrusting, very thin; thickness sometimes not more than .10 mm. Cells polygonal. Apertures occasionally circular, diameter .25 mm.; irregularly disposed, with frequent maculæ of larger cells, having the apertures .33 mm. in diameter.

This species is so thin that the arrangement of cells is sometimes determined by the object incrusted; some specimens growing upon *Trematopora* (*Orthopora*) *regularis* have their cells disposed in longitudinal, parallel rows. It may be distinguished from *P. incrustans* by its much smaller cells.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

PALESCHARA? (LICHENALIA?) BILATERALIS.

PLATE XVI, FIGS. 22, 23.

Paleschara? bilateralis, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 160. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 16, figs. 22, 23. 1883.

ZOARIUM consisting of an elongate, lamellate expansion, celluliferous on each face; thickness about 1 mm. Cells tubular, arising from a mesotheca. Apertures oval or polygonal, length .36 mm., width from one-half to three-fourths the length; sometimes irregularly disposed; at other times in longitudinal rows on the central portion of the frond, and on the lateral portions, more irregularly disposed in oblique ascending series. The surface has maculæ of larger cell apertures. Intercellular space vesiculose. The surface has not been observed in a perfect condition. Two fragments of this species have been observed.

The specimen has a general resemblance to a PTILODICTYA, but differs in having intercellular vesicular tissue.

Formation and locality. Lower Helderberg group, Clarksville, N. Y.

STICTOPORA, HALL. 1847.

STICTOPORA PAPILLOSA.

PLATE XIII, FIGS. 12, 13; AND PLATE XXIII A, FIG. 16.

Stictopora papillosa, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 161. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 13, figs. 12, 13. 1883.

ZOARIUM ramose, flattened; bifurcations frequent; width of branch from 2 to 2.50 mm. Transverse section flattened oval; greatest thickness 1 mm. Cell apertures circular, diameter .25 mm., those nearest the margin somewhat larger; generally arranged in indistinct longitudinal rows, frequently in contact: margins thick, strongly elevated, oblique, constricting the apertures.

The papillose margins of the cells, and the elongate form of a transverse section of a branch, are distinguishing features of this species.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

STICTOPORA OBSOLETA, n. sp.

PLATE XXIII A, FIG. 22.

ZOARIUM ramose, flattened; bifurcations distant about 10 mm.; width of branch 2 mm., increasing very slightly in width to the bifurcation. Width of the non-celluliferous space at the margin .40 mm. Cell apertures oval, length .25 mm., width .17 mm.; disposed in longitudinal parallel rows.

All the specimens of this species, so far observed, have been worn or macerated, but it is easily distinguished from any other of this formation by its larger size and the form and arrangement of the cell apertures.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Stictopora granatula, n. sp.

PLATE XI, FIG. 16; AND PLATE XXIII A, FIG. 17.

In part *Trematopora rhombifera*, Hall. Report of State Geologist for 1882. Expl. pl. 11, figs. 15–20.

Zoarium ramose, flattened; bifurcations moderately distant; branches not widely diverging; width, just above a bifurcation, 1 mm., increasing to 2 mm. Transverse section lenticular, greatest thickness .80 mm. Non-celluliferous space, at the margin, very narrow, scarcely perceptible. Cell apertures elongate-oval, length .33 mm., width .20 mm.; very closely disposed in more or less regular, oblique, transverse rows: margins very thin, slightly elevated or obsolete. Intercellular space generally flat and granulose; sometimes elevated and smooth.

This species very much resembles a flattened specimen of *Trematopora* (*Orthopora*) *rhombifera*, and might be readily mistaken for it when only the external characters can be seen.

Formation and localities. In the shaly limestone of the Lower Helderberg group, at Catskill creek, and near Clarksville, N. Y.

PTILODICTYA, Lonsdale. 1839.

Ptilodictya lirata.

PLATE XVII, FIGS. 1-4; AND PLATE XXIII A, FIG 20.

Escharopora lirata, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 100. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 161. 1879.
In part *Escharopora lirata*, Hall. Report of State Geologist for 1882. Expl. pl. 17, figs. 1–6. 1883.

Zoarium small, ensiform; gradually enlarging for a short distance from an obtusely pointed, striated base, the sides then becoming parallel; width from 1.50 to 2 mm.; transverse section lenticular, greatest thickness .75 mm. Celluliferous on both faces. Cells tubular, arising obliquely from the mesial lamina. Apertures elongate-oval, length .30 mm., width from .16 to .20 mm.; disposed in longitudinal parallel rows, five or six rows on each face. The apertures of the two outer rows larger than the others and oblique to

them. Rows of apertures separated by prominent granulose ridges. Between each two adjacent apertures are two minute triangular pits.

This species differs from *P. tenuis* (pl. xvii, figs. 7–13) in its smaller size, proportionally longer cells and the lirate appearance given to it by the ridges separating the longitudinal lines of cell apertures.

Formation and locality. In the upper shaly portions of the Lower Helderberg group, near Clarksville, N. Y.

PTILODICTYA TENUIS.

PLATE XVII, FIGS. 7-12; PLATE XIII, FIG. 14; AND PLATE XXIII A, FIG. 15.

Escharopora tenuis, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 99. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 161. 1879.
In part *Escharopora tenuis*, HALL. Report of State Geologist for 1882. Expl. pl. 17, figs. 7–13. 1883.

ZOARIUM consisting of a thin elongate stipe, with a thickened base; gradually enlarging from an obtuse point, for a short distance, beyond which the sides become essentially parallel; width varying from 3 to 7 mm.; transverse section lenticular; greatest thickness 1 mm. Cells tubular, arising obliquely from the mesotheca. Apertures oval or subquadrangular, though frequently assuming other forms from thickening by silicification; disposed in longitudinal parallel ranges; on the central portion of the stipe they are essentially of the same size; length .30 mm., width .20 mm.; marginal cells variable in size and arrangement and diverging from the axis of the frond. Between adjacent cell apertures there are sometimes two minute cellules. Cell walls of the parallel ranges in contact laterally, generally coalescing, and very often becoming much thickened by silicification, especially on the surface, where they form strong longitudinal ridges, separating the rows of cell apertures; outer portion of the cell wall very thin.

This species is associated with *P. lirata*, and further investigation may show that the two forms represent different conditions or stages of growth of a single species.

Formation and localities. In the shaly limestone of the Lower Helderberg group, Albany and Schoharie counties, N. Y.

PTILODICTYA NEBULOSA.

PLATE XVII, FIGS. 13-18.

Escharopora nebulosa, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 99. 1874.
" " " Thirty-second Repl. N. Y. State Mus. Nat. Hist., p. 162. 1879.
In part *Escharopora (Ptilodictya) tenuis*, HALL. Report of State Geologist for 1882. Expl. pl. 17, figs. 7–13. 1883.
Escharopora (Ptilodictya) nebulosa, HALL. Report of State Geologist for 1882. Expl. pl. 17, figs. 14–16. 1883.
Paleschara bifoliata, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 107. 1874.
Escharopora (? Paleschara) bifoliata, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 162. 1879.
Paleschara? foliata (in error), HALL. Report of State Geologist for 1882. Expl. pl. 17, figs. 17, 18. 1883.

ZOARIUM a thin foliate expansion, with a thickened, narrow, striated base, from which it abruptly expands. Cells tubular, arising obliquely from a mesotheca; arranged in subparallel longitudinal rows, rarely interrupted by the intercalation of additional rows. Apertures oval or subquadrangular, a little longer than wide; length 30 mm. Cell walls coalescing and thickened on the surface by silicification, forming prominent longitudinal ridges. Surface marked by slightly elevated monticules, the centres of which are distant from each other about 3 mm.; on these the cells are larger than the others and the cell walls thicker; width of the largest specimen observed 70 mm.

This species is readily distinguished from the others by its broadly spreading form and the numerous slightly elevated monticules.

The fossil described as *Paleschara bifoliata* in the Twenty-sixth Report of the State Museum of Natural History has proved, on further examination, to be a specimen of *Ptilodictya nebulosa*, in a crushed and distorted condition.

Formation and localities. Lower Helderberg group, Catskill creek, and near Clarksville, N. Y.

RHINODICTYA, ULRICH. 1882.

RHINODICTYA? GRANULOSA, n. sp.

PLATE XVII, FIGS. 5, 6; AND PLATE XXIII A, FIGS. 18, 19.

In part *Escharopora (Ptilodictya) lirata*, HALL. Report of State Geologist for 1882. Expl. pl. 17, figs. 1–6. 1883.

ZOARIUM consisting of a bifurcating flattened stipe; bifurcations very infrequent.

Base obtusely pointed; sides essentially parallel, width 1.50 mm.; transverse

section lenticular, greatest thickness .75 mm. Non-celluliferous space at the margin extremely narrow. Cell apertures oval, disposed in longitudinal parallel rows, six rows on each face of the branch. Length of apertures, of the four central rows, about .18 mm., width .14 mm.; the two outer ranges are oblique to the axis and larger than the others; length .40 mm.: margins of apertures of central rows sometimes obscure or obsolete. Interapertural space elevated, angular, with a row of granules along the middle: margins of apertures of outer ranges very thin, but distinct and granulose. Size of apertures varying somewhat, from the thickening of the interapertural space by silicification.

This species in some of its features is very similar to PTILODICTYA, but it differs from that genus in being bifurcate and having an obtusely pointed base. This latter feature would exclude it from the genus STICTOPORA, which has a thin expanded base, attached to foreign bodies. The specimens of this species examined possess the essential characters of RHINODICTYA as described and illustrated by Mr. Ulrich.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

THAMNISCUS, KING. 1849.

THAMNISCUS VARIOLATA.

PLATE XXII, FIGS. 34-46.

Thamniscus variolata, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 175. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 22, figs. 34-46. 1883.

ZOARIUM fruticose, several stems arising from a common base, rapidly spreading laterally, sometimes forming an infundibuliform frond. Bifurcations very frequent, occurring at intervals of from 1 to 3 mm., but seldom more than 2 mm.; branches clavate, much widened before bifurcation; width of a branch variable, but generally about .75 mm. above a bifurcation, increasing to 1.50 mm. On the specimens observed the non-celluliferous face is smooth. Cells tubular, apertures circular, diameter .25 mm.; those nearest the margin sometimes slightly larger than the others; irregularly

and closely disposed, very frequently in contact and always distant less than the diameter of an aperture: margins strong, elevated, those of the outer ranges projecting beyond the branch. Branches usually round, but sometimes decidedly angular. Diameter of specimens 15 mm. or more.

The very frequent bifurcations and the clavate branches are distinguishing features of this species.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Thamniscus fruticella.

PLATE XXII, FIG. 33.

Thamniscus fruticella, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 176. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 22, fig. 33. 1883.

Zoarium consisting of a main stem and lateral branches. Bifurcations frequent, occurring, on the specimens observed, at intervals of about 4 mm. Branches above the bifurcation 1 mm. wide, increasing to 1.50 mm.; clavate; non-celluliferous face rounded, striated. The celluliferous face has not been observed, but some of the branches of the non-celluliferous face have been so much worn by maceration, that the bases of the cells can be seen. They are numerous, three in the space of five mm., and irregularly arranged.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Thamniscus? Cisseis.

PLATE XXII, FIGS. 24–30.

Thamniscus? Cisseis, Hall. Thirty-second Rept. N. Y. State Mus. Nat Hist, p. 176. 1879.
In part *Thamniscus? Cisseis*, Hall. Report of State Geologist for 1882. Expl. pl. 22, figs. 23–30. 1883.

Zoarium ramose, solid; celluliferous on one face. Bifurcations occurring at intervals of from 3 to 4 mm. Transverse section of a branch circular, diameter 1 mm. Branches more or less curved; on the non-celluliferous face marked by fine, numerous striæ. Cells tubular, length about .75 mm., regularly curving and gradually enlarging to the surface. Apertures circular or broadly oval, sometimes sub-polygonal from mutual pressure; diameter about .30 mm.; those nearest the margin are larger and more oval than the

others; very closely arranged in quincunx, nearly in contact: margins very thin, scarcely elevated above the surrounding surface. Interapertural space flat; granulose.

The general appearance and arrangement of the cell apertures will distinguish this species from any similar form in the same horizon.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

THAMNISCUS? NYSA.

PLATE XXII, FIGS. 31, 32, 47, 48.

Thamniscus Nysa, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 175. 1879.
" " var. HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 176. 1879.
" " " " Report of State Geologist for 1882. Expl. pl. 22, figs. 31, 32. 1883.
" " HALL. Report of State Geologist for 1882. Expl. pl. 22, figs. 47, 48. 1883.

ZOARIUM ramose, solid. Bifurcations frequent; branches 1 mm. in diameter, very slightly enlarging before bifurcation; frequently curved. Non-celluliferous face obscurely striated. Cells tubular, opening directly outward; diameter of apertures .15 mm.; disposed in oblique transverse rows; distance between rows equal to the diameter of an aperture, the apertures forming the transverse rows nearly or quite in contact: margins thin, strongly elevated.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

FENESTELLA (MILLER), LONSDALE. 1839.

FENESTELLA CREBRIPORA.

PLATE XX, FIGS. 1-3.

Fenestella crebripora, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 95. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 167. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 20, figs. 1-3. 1883.

BRYOZOUM infundibuliform. Branches slender, rounded or sub-angular, marked by very fine striæ which are often indistinct. Bifurcations distant from 4 to 10 mm. Width of interstices greater than that of the branches. Dissepiments slender, often oblique, on the same plane as the branches, five in the space of 5 mm. Fenestrules sub-quadrangular, often rhomboidal, width usually about one-half the length.

On the celluliferous face the branches are angular and the dissepiments depressed. Cell apertures moderately large, circular, in two ranges opening laterally; eighteen in the space of 5 mm., with interspaces equal to the diameter of an aperture. There is usually an additional aperture immediately below a bifurcation. When the specimen is somewhat worn or macerated, the apertures appear larger, more closely arranged, and open more upon the side of the branch.

Width of branches above bifurcation .25 mm., increasing to .50 mm.; diameter of dissepiments .20 mm.; length of fenestrules from .75 to .80 mm.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella junceus.

PLATE XX, FIGS. 16-18.

Fenestella junceus, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 168. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 20. figs. 16-18. 1883.

Bryozoum infundibuliform, gradually expanding. Branches slender, slowly increasing in size; rounded and marked by from six to seven striæ on each branch. Width of the interstices about equal to that of the branches. Dissepiments slender, rounded, striated, very slightly expanding at their junction, and on the same plane with the branches. Fenestrules elongate, sub-quadrangular.

On the celluliferous face the branches are angular and the dissepiments much depressed. Fenestrules of the same appearance as on the opposite face. Cell apertures comparatively large, circular, in two ranges, opening laterally; twenty-five in the space of 5 mm.; separated by a distance equal to the diameter of an aperture; margins slightly elevated.

Width of a branch above bifurcation .30 mm., increasing to from 50 to .60 mm.; diameter of dissepiments .25 mm.; length of fenestrules generally 1 25 mm., sometimes 1.50 mm., width from .25 to .40 mm., usually about .33 mm

Formation and locality. Lower Helderberg group, Clarksville, N. Y.

Fenestella Cleia.

PLATE XX, FIGS. 14, 15.

Fenestella Cleia, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 169. 1879.
" " " Report of State Geologist for 1882. Expl. pl 20, figs. 14, 15. 1883.

Bryozoum infundibuliform, broadly spreading; branches moderately strong, somewhat rigid, sub-angular or rounded, smooth in the specimens observed, regularly and rapidly increasing in size to the bifurcations, which occur at intervals of from 3 to 5 mm. Interstices generally narrower than the branches Dissepiments slender, rounded; eight in the space of 5 mm.; not expanding, slightly depressed below the plane of the branches. Fenestrules sub-quadrangular, occasionally square near the base.

On the celluliferous face the branches are obtusely angular and the dissepiments depressed. The fenestrules appear narrower than on the opposite face. Cell apertures small, circular, in two ranges, opening directly outward; twenty in the space of 5 mm.; separated by less than the diameter of an aperture: margins elevated, very slightly indenting the borders of the fenestrules. The middle of the branch is occupied by a low rounded ridge, with frequently a slight groove on each side.

Width of branches from .25 to .30 mm., increasing to 50 mm.; diameter of dissepiments about .20 mm.; length of fenestrules about .40 mm., width from .25 to .35 mm.

This species somewhat resembles *F. quadrula*, but the branches increase more rapidly in size, the dissepiments are stronger, and on the celluliferous face the carina is very slightly elevated, while in that species the carina is elevated and has an expanded, crenulated summit.

Formation and locality. Lower Helderberg group, Clarksville, N. Y.

Fenestella Hestia.

PLATE XX, FIGS. 12, 13.

Fenestella Hestia, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 168. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 20, figs. 12, 13. 1883.

This species is represented in the collections by a small fragment showing the non-celluliferous face. The branches are moderately strong, gradually in-

creasing in size to a bifurcation; marked by from one to four sharp lines or striæ, which are strongly nodose along their summits. Bifurcations infrequent. Dissepiments slender, depressed. Interstices usually equal to the width of the branches. Fenestrules oval or sub-quadrangular, length about twice the width.

On the fragment described there are from nine to eleven branches in the space of 5 mm. measured transversely, and seven fenestrules in the same space measured longitudinally.

This species bears some resemblance to the non-celluliferous face of some specimens referred to *F. (U.) Nervia*, but may be readily distinguished by its more slender branches, wider interspaces and sub-quadrangular fenestrules.

Formation and locality. In the shaly limestone of the Lower Helderberg group, at Schoharie, N. Y.

Fenestella Æsyle.

PLATE XIX, FIGS. 11-13.

Fenestella Æsyle, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 166. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 19, figs. 11-13. 1883.

Bryozoum probably infundibuliform. Branches slender, rounded, marked by obscure striæ. Bifurcations frequent, occurring at intervals of from 2 to 5 mm. Width of interstices greater than that of the branches. Dissepiments rounded, six in the space of 5 mm., slightly expanding at their junction, and on the same plane with the branches. Fenestrules sub-quadrangular, or broadly oval, width from one-half to two-thirds the length.

Cell apertures small, circular, opening directly outward, twenty-five in the space of 5 mm.; disposed in two or three ranges, with sometimes an additional aperture just below a bifurcation.

Width of branch just above a bifurcation .20 mm., increasing to .50 mm.; width of dissepiments from .20 to .25 mm.; fenestrules .60 mm. long.

The specimen represented by fig. 13, pl. xix, is more lax in its growth than the ordinary forms of this species.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella Noe, n. sp.

PLATE XIII, FIGS. 19-22.

Fenestella, sp. Report of State Geologist for 1882. Expl. pl. 13, figs. 19-22. 1883.

Form not definitely known. Branches slender, rounded and smooth, increasing in size more or less gradually according to the frequency of the bifurcations, which occur at intervals of from 2 to 15 mm., generally about 7 mm. Interstices wider than the branches. Dissepiments very slender, irregularly disposed; four or five in the space of 5 mm., on the same plane with the branches. Fenestrules sub-quadrangular, varying in size, width generally one-fifth to one-half the length.

On the celluliferous face the branches are angular, nodose along the middle and the dissepiments are depressed. Fenestrules of about the same appearance as on the opposite face. Cell apertures circular, in two ranges, opening somewhat laterally, eighteen in the space of 5 mm.; margins elevated, indenting the borders of the fenestrules.

Width of branch above bifurcation .25 mm., increasing to .55 mm. Diameter of dissepiments .20 mm., length of fenestrules .75 to 1.50 mm.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella Spio, n. sp.

PLATE XIX, FIG. 16.

Fenestella sp.? Hall. Report of State Geologist for 1882. Expl. pl. 19, fig. 16. 1883.

Bryozoum infundibuliform, compact. Branches moderately slender, angular, frequently sinuous or zigzag on the non-celluliferous face. Bifurcations infrequent. Interstices wider than the branches. Dissepiments strong, angular, seven or eight in the space of 5 mm., expanded at their junction and on the same plane with the branches. Fenestrules broadly oval or circular, width nearly or quite equal to the length.

On the celluliferous face the branches are nodose and angular, or very abruptly rounded, and appear much narrower than on the opposite face.

Dissepiments rounded and much depressed. The fenestrules appear larger and more quadrangular than on the opposite face. Cell apertures small, circular, in two ranges, opening laterally; twenty-five in the space of 5 mm., distant less than the diameter of an aperture.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella Althæa.

PLATE XIX, FIGS. 17–19.

Fenestella Althea, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 166. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 19, figs. 17–19. 1883.

Bryozoum infundibuliform, of somewhat lax growth. Branches slender, rounded, marked by fine striæ. Bifurcations distant, frequently occurring at intervals of 15 mm. or more. Interstices wider than the branches. Dissepiments very slender, three in the space of 5 mm.; frequently oblique to the branches. Fenestrules quadrangular, sometimes rhomboidal from the obliquity of the dissepiments.

On the celluliferous face the branches are angular and the fenestrules appear oval. Cell apertures circular or slightly oval, in two ranges, with additional apertures just below a bifurcation; about twenty in the space of 5 mm.; distant less than half the diameter of an aperture.

This species, in some of its features, closely resembles *F. crebripora*, but it is of much coarser growth.

Formation and locality. Lower Helderberg group, Albany county, N. Y.

Fenestella Adraste.

PLATE XX, FIGS. 19–22.

Fenestella Adraste, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 169. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 20, figs. 20–22. 1883.
" *sp. ?* " Report of State Geologist for 1832. Expl. pl. 20, fig. 19. 1883.

Bryozoum infundibuliform, compact. Branches moderately strong, flat, with a prominent carina along the middle, and on the wider portions of the branch there is occasionally a striation on each side of the carina. Bifurcations

comparatively infrequent. Interstices usually narrower than the branches. Dissepiments slender, six in the space of 5 mm., on the same plane as the branches and much expanded at their junction. Fenestrules oval or sub-quadrangular, width from one-third to one-half the length.

On the celluliferous face the branches are angular. Dissepiments angular and much depressed. Cell apertures circular, in two ranges, opening somewhat laterally, twenty in the space of 5 mm., closely disposed, frequently in contact: margins strong, elevated and indenting the borders of the fenestrules. Between the ranges of cell apertures there is a thin carina, having a height of about .30 mm.

Width of branch above a bifurcation from .35 to .40 mm., increasing to .75 mm.; diameter of dissepiments .20 mm.; length of fenestrules .65 mm.

This species, on the non-celluliferous face, is characterized by its flat carinated branches, in which feature it differs from any other of this formation.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella Sylvia.

PLATE XX, FIGS. 4-7.

Fenestella Sylvia, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 96. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 167. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 20, figs. 4–7. 1883.

Bryozoum infundibuliform, broadly spreading, strongly undulating. Branches slender, gradually and regularly increasing in size to the bifurcations, which occur at intervals of from 5 to 15 mm., generally not less than 10 mm.; marked by from three to five moderately strong striæ on each branch. Sometimes the central striation is so prominent as to give an angular or carinated appearance to the branch. Interstices wider than the branches. Dissepiments very slender, expanding at their junction and on the same plane with the branches, eight in the space of 5 mm. Fenestrules variable in form, regularly oval near the base, becoming broadly oval or sub-quadrangular above. Width usually from one-half to two-thirds the length, but sometimes equal to, or greater than, the length.

On the celluliferous face the branches are angular and the dissepiments much depressed. The fenestrules appear somewhat narrower and more regular than on the opposite face. Cell apertures small, circular, three in the length of a fenestrule, disposed in two ranges, opening laterally at an angle of forty-five degrees to the axis of the branch: margins elevated, slightly indenting the borders of the fenestrules. Between the ranges of apertures there is a line of nodes along the summit of the branch.

Width of branches at first .25 mm., increasing to .75 mm. Diameter of dissepiments from .16 to .18 mm.; length of fenestrules from .40 to .50 mm.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella Philia.

PLATE XX, FIGS. 9-11.

Fenestella Philia, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 168. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 20, figs. 9–11. 1883.

Bryozoum probably infundibuliform, and radially plicate. Branches slender, rounded and smooth, from twelve to sixteen in the space of 5 mm. Dissepiments slender, nine in the space of 5 mm. Interstices usually wider than the branches. Fenestrules sub-quadrangular.

On the celluliferous face the branches are angular and marked by a line of nodes along the center. Cell apertures in two ranges, small, circular or suboval, three in the space of one fenestrule, distant from each other more than the diameter of an aperture.

Formation and locality. In the shaly limestone of the Lower Helderberg group, near Clarksville, N. Y.

Fenestella Thyene.

PLATE XXI, FIGS. 1-5.

Fenestella Thyene, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 170. 1879.
Fenestella Thyene, Hall. Report of State Geologist for 1882. Expl. pl. 21, figs. 1–5. 1883.

Bryozoum infundibuliform, growing directly from a spreading base without a pedicel. Branches moderately strong, angular, compactly arranged, straight

when the dissepiments are opposite, becoming more or less sinuous or zigzag when the dissepiments alternate. Bifurcations frequent. Interstices narrower than the branches. Dissepiments strong, angular, seven or eight in the space of 5 mm., on the same plane, or slightly elevated above the branches, sometimes continuing across the branches, uniting with other dissepiments forming a continuous irregular elevation, which is more prominent than the branches. Fenestrules broadly oval, sometimes nearly circular.

On the celluliferous face the branches are broadly angular and the dissepiments rounded and much depressed. The fenestrules appear narrower than on the opposite face. Cell apertures in two ranges, opening directly outward, twenty in the space of 5 mm., distant a little more than the diameter of an aperture: margins elevated, not indenting the borders of the fenestrules. Branches with comparatively strong carinæ having a height of .10 mm., slightly expanded along the summits.

Width of branch above a bifurcation .25 mm., increasing to .50 mm.; diameter of dissepiments .33 mm.; fenestrules .38 mm. long.

This species on the non-celluliferous face resembles *F. Coronis*, but is distinguished by its more compact growth, slender branches and oval fenestrules.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella Coronis.

PLATE XXI, FIGS. 10–13.

Fenestella Coronis, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 171. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 21, figs. 10–13. 1883.

Bryozoum infundibuliform, radially undulating. Branches strong, angular or rounded on the non-celluliferous side, and flattened for a short distance below the bifurcation. Dissepiments strong, angular, slightly expanded at their junction, and on the same plane with the branches.. Fenestrules oval or quadrangular, varying in size and form, and generally wider than the branches.

On the celluliferous face, the branches and dissepiments are angular, and the latter much depressed. The fenestrules appear narrower than on the

opposite face. Cell apertures in two ranges, circular, opening directly outward, twenty in the space of 5 mm., separated by less than the diameter of an aperture: margins elevated, not indenting the borders of the fenestrules. Branches bearing prominent carinæ which are expanded and angular along their summits.

Width of branches above the bifurcations .33 mm., increasing to .75 mm.; diameter of dissepiments .25 mm.; fenestrules varying from .60 to .75 mm. in length and from .40 to .60 mm. in width; height of carina .40 mm.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella Idalia.

PLATE XXI, FIGS. 6-9.

Fenestella Idalia, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 95. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 170. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 21, figs. 6-9. 1883.

Bryozoum infundibuliform, broadly spreading, nearly flat for a short distance above the base. Branches moderately slender, rounded, compactly arranged, regularly increasing in size to the bifurcations, marked by from three to five granulose striations on each branch; sometimes so strongly granulose as to obscure the striæ. Bifurcations frequent. Interstices usually about the width of the branches. Dissepiments very slender, sub-angular, from six to nine in the space of 5 mm., very slightly expanding at their junction, and on the same plane with the branches. Fenestrules sub-quadrangular, occasionally oval.

On the celluliferous face the branches are angular, or sub-carinated. Dissepiments angular and much depressed. The fenestrules appear narrower than on the opposite face. Cell apertures usually in two ranges, circular, opening somewhat laterally and separated by less than the diameter of an aperture: margins elevated, indenting the borders of the fenestrules.

Width of branch above a bifurcation .20 mm., increasing to .50 mm.; diameter of dissepiments .16 mm.; length of fenestrules on different specimens varying from .40 to .50 mm., width from .25 to .40 mm.

This species is distinguished by the lateral spreading of the frond at a short distance above the base, the compactly arranged branches and the very slender dissepiments and small fenestrules.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella quadrula.

PLATE XXI, FIGS. 19–22.

Fenestella quadrula, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 172. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 21, figs. 19–22. 1883.

Bryozoum infundibuliform, gradually expanding. Branches moderately strong, rounded, very gradually increasing in size and becoming flattened before bifurcating; marked by from one to three striations on each branch. Sometimes, for a short distance above a bifurcation, there is a single striation along the middle of the branch, which then appears angular and carinated. Transverse section of the branch usually nearly circular. The bifurcations are at intervals of from 3 to 5 mm. Width of the interstices nearly equal to the branches. Dissepiments very slender, nine in the space of 5 mm., on the same plane with the branches, and not expanding at their junction. Fenestrules quadrangular, occasionally square.

On the celluliferous face the branches are angular, the dissepiments are rounded and much depressed The fenestrules appear slightly narrower than on the opposite face. Cell apertures in two ranges opening directly outward, twenty in the space of 5 mm., separated by less than the diameter of an aperture: margins elevated, indenting the borders of the fenestrules. Branches with prominent, thin carinæ, which is abruptly expanded along the summit and marked in the middle by a thin, sharp crest. The margins of the expanded summits bear a row of small nodes which frequently have the appearance of minute apertures, five in the space of 1 mm.

Width of branch at first .33 mm., increasing to .50 or .60 mm.; diameter of dissepiments .16 mm.; fenestrules .40 mm. long and .30 mm. wide; height of carina .40 mm.

This species is characterized by its quadrangular fenestrules and its very slender dissepiments which do not expand at their junction with the branches.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

UNITRYPA, HALL. 1885.

FENESTELLA (UNITRYPA) PRÆCURSOR.

PLATE XXI, FIGS. 14-18.

Fenestella præcursor, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 94. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 171. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 21, figs. 14-18. 1883.

BRYOZOUM infundibuliform, not rapidly expanding, growing directly from the spreading base without a pedicel. Branches moderately strong, gently rounded, very gradually increasing in size to the bifurcations, often sub-parallel for some distance; marked by two or three coarse granulose striæ on each branch. The granules or nodes are sometimes so prominent as to obliterate all other surface markings, but are often regularly arranged. Interstices narrower than the branches. Dissepiments strong, rounded, granulose, six or seven in the space of 5 mm., on a plane with the branches. Fenestrules oval or sub-quadrangular, width from one-half to two-thirds the length.

On the celluliferous face the branches and dissepiments are angular and the latter much depressed. The fenestrules appear somewhat smaller and more regularly oval than on the opposite face. Cell apertures oval, in two ranges, opening directly outward and obliquely to the axis of the branch; eighteen in the space of 5 mm., separated by less than the diameter of an aperture: margins elevated, indenting the borders of the fenestrules. Branches carinated; carina thin below, rapidly expanding above, into an angular summit with a thin sharp crest along the middle and on each margin a row of nodes, sometimes appearing like minute apertures. Either on account of the more perfect condition of the frond or the more advanced stage of growth, the nodes of contiguous carinæ are sometimes extended until they unite, forming slender bars connecting them.

Branches varying in width from .30 to .35 mm., increasing to .75 mm.; diameter of dissepiments .25 mm.; fenestrules from .50 to .60 mm. in length

over the greater portion of the frond. The summit of the carina has a width of .35 mm.

In the normal condition of this species, the margins of the expanded summits of the carinæ have simply a row of nodes. In some specimens a few of the nodes extend and form lateral processes which unite with those opposite side connecting the summits of the carinæ. Over the greater portion of one specimen all the nodes are thus extended and united giving to it the essential character of UNITRYPA. This species shows the manner of growth of UNITRYPA and its intimate connection with FENESTELLA; also the impossibility of forming a distinctly limited genus from these forms.

Formation and locality. Lower Helderberg group, Near Clarksville, N. Y.

FENESTELLA (UNITRYPA) NERVIA.

PLATE XXII, FIGS. 1-3, 6, (9, 10)?

Fenestella Nervia, HALL. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 93. 1874.
Hemitrypa prima, " Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 98. 1874.
Fenestella (Hemitrypa) Nervia. HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 173. 1879.
In part *Fenestella (Hemitrypa) Nervia?* HALL. Report of State Geologist for 1882. Expl. pl. 22, figs. 1–6, 9, 10. 1883.

BRYOZOUM infundibuliform, broadly spreading and radially undulated or folded. Branches moderately strong, rounded, granulose. Bifurcations frequent. Interstices narrower than the branches. Dissepiments strong, about six in the space of 5 mm. Fenestrules oval, width generally about one-half the length.

On the celluliferous face the fenestrules usually appear much narrower than on the opposite side. Cell apertures in two ranges, small, circular, distant less than the diameter of an aperture; margins distinctly elevated, not indenting the borders of the fenestrules. Branches marked by strong, elevated carinæ, which have their summits slightly expanded and connected by slender lateral processes.

Width of branch above a bifurcation .33 mm., increasing to .50 or .60 mm.; width of dissepiments .35 mm.; length of fenestrules .50 mm.

The elevated carinæ with the connecting bars are very fragile and are wanting on the greater portion of the specimens observed.

Formation and locality. In the shaly limestone of the Lower Helderberg group, Clarksville, N. Y.

Fenestella (Unitrypa) Nervia, var. constricta.

PLATE XXII, FIGS. 11, 12.

Fenestella (Hemitrypa) Nervia, var. *constricta*, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 174. 1879.

" " " " " Report of State Geologist for 1882. Expl. pl. 22, figs. 11, 12. 1883.

Bryozoum infundibuliform, compact. Branches moderately strong, slightly diverging, essentially parallel, very gradually increasing in size to the bifurcations, marked on the non-poriferous side by from three to six strongly granulose striæ. Transverse section of branch broadly oval. Bifurcations infrequent. Interstices narrow. Dissepiments rounded, granulose, very slightly depressed, about eight in the space of 5 mm. Fenestrules oval, width from one-half to three-fourths the length.

On the celluliferous face the branches are angular and the dissepiments much depressed. Cell apertures small, sub-circular, in two ranges, opening somewhat laterally, twenty-five in the space of 5 mm., distant less than the diameter of an aperture: margins strongly elevated on the anterior, indenting the borders of the fenestrules. Branch bearing a very thin carina, which is slightly expanded along the summit and connected by irregular lateral processes, which sometimes continue from the summit of one carina to that of another; at other times they meet midway, coalesce and form an indistinct, irregular ridge.

Width of branch above a bifurcation .40 mm., increasing to .60 mm. Dissepiments from .20 to .25 mm. in diameter; fenestrules about .40 mm. long; height of carina .40 mm., summit .14 mm. wide.

This variety is easily distinguished by its compact form, sub-parallel branches, the usually irregular character of the connecting processes, and the narrow summits of the carinæ.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

HEMITRYPA, PHILLIPS. 1841.

FENESTELLA (HEMITRYPA) BISERIALIS.

PLATE XXII, FIGS. 13, 16-18.

Fenestella (Hemitrypa) biserialis, HALL. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 174. 1879.
In part *Fenestella (Hemitrypa) biserialis*, HALL. Report of State Geologist for 1882. Expl. pl. 22, figs. 13-18. 1883.

BRYOZOUM infundibuliform, regularly expanding. Branches strong, rounded, marked on the non-celluliferous face by single, prominent, triangular nodes, which usually occur opposite the dissepiments. Interstices usually narrower than the branches. Dissepiments strong, rounded, slightly depressed. Fenestrules small, oval, width about one-half the length.

On the celluliferous face the branches are angular, and the dissepiments rounded and depressed. The fenestrules appear narrower than on the opposite face. Cell apertures small, circular, in two ranges, opening directly outward, twenty in the space of 5 mm., distant less than the diameter of an aperture. Branches bearing strong carinæ, which are expanded along their summits, sending off processes, which, meeting with similar processes from the adjacent carinæ, coalesce midway between the branches forming a ridge, which is not so strong as the summits of the carinæ. There are four processes in the space of 1 mm. Interstices formed by the connecting bars subquadrangular, width greater than the length.

Width of branch above a bifurcation .30 mm., increasing to .50 or .60 mm.; dissepiments from .40 to .45 mm in diameter; fenestrules about .45 mm. long.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

FENESTELLA (HEMITRYPA) BISERIALIS, var. EXILIS, n. var.

PLATE XXII, FIGS. 14, 15.

In part *Fenestella (Hemitrypa) biserialis*, HALL. Report of State Geologist for 1882. Expl. pl. 22, figs. 13-18. 1883.

BRYOZOUM infundibuliform, gradually expanded. Branches moderately slender, rounded or angular on the non-celluliferous face, and frequently with a strong

node opposite the dissepiments. Width of the interstices about equal to that of the branches. Dissepiments very slender, angular, slightly depressed below the plane of the branches, eight in the space of 5 mm. Fenestrules sub-quadrangular, width from one-half to two-thirds the length.

On the celluliferous face the branches are angular and the dissepiments rounded and depressed. The fenestrules appear more oval in form than on the opposite face. Cell apertures small, circular, in two ranges, opening directly outward, twenty-five in the space of 5 mm., distant less than the diameter of an aperture: margins elevated and indenting the borders of the fenestrules. Branches carinated; the summits of the carinæ are expanded, angular and connected by lateral processes which meet midway between the branches, coalesce and form a flattened zigzag ridge. The lateral processes correspond in number and are situated over the cell apertures. The interstices are oval, and wider than long.

Width of branch above a bifurcation .20 mm., increasing to .50 mm.; dissepiments from .18 to .20 mm. in diameter; length of fenestrules from .40 to .60 mm.; height of carina .20 mm.

This form differs from *F.* (*H.*) *biserialis* in its more delicate growth, smaller branches, and the more slender and closely arranged dissepiments.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

POLYPORA, McCoy. 1845.

Fenestella (Polypora) Eudora.

PLATE XIX, FIGS. 3, 4, 5? 6-10.

Fenestella Eudora, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 165. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 19, figs. 3-10. 1883.

Bryozoum broadly infundibuliform, growing from a very slender pedicel, having a diameter less than 1 mm. Branches moderately slender, very gradually increasing in size to the bifurcations, which occur at intervals of from 3 to 15 mm., and are more frequent near the base than above. On the non-celluliferous face the branches are rounded, sometimes flattened just below a bifurcation, marked by from five to seven very fine, distinct striæ

on each branch. Width of interstices about equal to that of the branches. Dissepiments moderately slender, abruptly rounded, four in the space of 5 mm., slightly depressed below the plane of the branches and not expanding at their junction. Fenestrules quadrangular, varying in width from one-fourth to one-half their length.

On the celluliferous face the branches are rounded, and the dissepiments much depressed. Fenestrules of the same appearance as on the opposite face. Cell apertures circular, opening laterally, distant about one-half the diameter of an aperture, from twenty to twenty-two in the space of 5 mm., disposed in two ranges, with occasionally one or two additional apertures immediately below the bifurcation: margins thick, elevated, indenting the borders of the fenestrules. The branch, sometimes, has a slightly elevated, very thin carina, which is scarcely perceptible.

Width of branch above bifurcation .30 mm., increasing to .50 or .60 mm.; diameter of dissepiments .24 mm.; length of fenestrules generally, about 1 mm.

Formation and locality. Lower Helderberg group, Clarksville, N. Y.

Fenestella (Polypora) stricta, n. sp.

PLATE XIX, FIGS. 1, 2.

Fenestella Eudora? Report of State Geologist for 1882. Expl. pl. 19, figs. 1, 2. 1883.

Bryozoum probably infundibuliform, compact. Branches moderately slender, rounded, becoming flattened for a short distance before bifurcating, marked by fine, sharp, longitudinal striæ. Bifurcations distant, often 15 mm. or more apart. Interstices about equal in width to the branches. Dissepiments rounded, seven or eight in the space of 10 mm., expanded at their junction with, and on the same plane as the branches. Fenestrules quadrangular or elongate-oval, width from one-fifth to one-half the length.

On the celluliferous face the branches are angular, becoming rounded for a short distance before bifurcation. Dissepiments rounded, much depressed. Fenestrules of the same appearance as on the opposite face. Cell apertures

circular, in two and three ranges, opening directly outward, eighteen or twenty in the space of 5 mm., separated by less than the diameter of an aperture. Three ranges of apertures usually occur, only for 1 or 2 mm. on the branch before bifurcating, but sometimes the intermediate range extends for 4 or 5 mm.: margins elevated, indenting the borders of the fenestrules. Branch with a very slight carina between the ranges of cell apertures.

This species is distinguished by its closely arranged, sub-parallel branches, distant bifurcations, and its rigid appearance.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella (Polypora) Idothea.

PLATE XIX, FIGS. 14, 15.

Polypora elegans? Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 97. 1874.
Fenestella Idothea, " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 166. 1879.
" " " Report of State Geologist for 1882 Expl. pl. 19, figs. 14, 15. 1883.

Bryozoum observed only as flattened fragments, the form of a perfect specimen is, therefore, not definitely known. Branches moderately slender, rounded on the non-celluliferous side, and marked by fine striæ. Bifurcations frequent. Width of interstices greater than that of the branches. Dissepiments slender, rounded, six in the space of 5 mm., expanded at their junction, and on the same plane as the branches. Fenestrules sub-quadrangular, longer than wide.

On the celluliferous face the branches are angular or sub-angular, appearing stronger than on the opposite face. Dissepiments rounded, sometimes angular and depressed. Cell apertures oval, in two and three ranges, opening laterally, length nearly twice the width, and separated by a space equal to one-half the length of an aperture, from eighteen to twenty-two in the space of 5 mm.: margins slightly elevated, not indenting the borders of the fenestrules Between the ranges of apertures, the branch is rounded or sub-angular, and marked by very fine tortuous striæ.

Width of branch above a bifurcation .25 mm., increasing to .40 mm.; diameter of dissepiments .20 mm.; length of fenestrules from .40 to .60 mm.; width from .30 to .40 mm.

This species is characterized by its somewhat straggling manner of growth, and the comparatively large, distinctly oval, and closely disposed cell apertures.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella (Polypora) compressa.

PLATE XVIII, FIGS. 14–18.

Fenestella compressa, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 164. 1879.
" *planiramosa*, " Report of State Geologist for 1882. Expl. pl. 18, figs. 14–18. 1883.

Bryozoum infundibuliform, rapidly expanding. Branches strong, bifurcations at intervals of from 4 to 10 mm.; on the non-celluliferous side sub-angular, becoming flattened and for a short distance before bifurcation concave, or with a slight channel along the middle; marked by from six to nine finely granulose lines on each branch, which when the specimen is well preserved are very distinct. Interstices usually wider than the branches. Dissepiments comparatively slender, rounded, on a plane with the branches. Fenestrules sub-quadrangular.

On the celluliferous face the branches are angular, sub-carinated, becoming flattened or concave as they approach the bifurcation. Dissepiments angular, ribbed, much depressed. Fenestrules essentially of the same appearance as on the opposite face. Cell apertures large, circular, from twelve to fifteen in the space of 5 mm., separated by less than the diameter of an aperture; disposed in two and three ranges, with occasionally four ranges immediately below a bifurcation; the outer rows open laterally, the central row or rows directly outward: margins slightly elevated, not indenting the borders of the fenestrules. Between the ranges of apertures the branches are angular, with distant triangular nodes, and the wider portions of the branches are nearly square in their transverse section, so that in looking directly at the specimen, the outer rows of apertures cannot be seen.

Width of branches .30 to .40 mm., increasing to a little less than 1 mm.; diameter of dissepiments usually .30 mm.; length of fenestrules 1.35 mm., width from .33 to .80 mm.

This species is characterized by the form of the branches, which are rhomboidal in transverse section for some distance above a bifurcation and square in the wider portions. It resembles *F. paxillata*, but has somewhat stronger branches, and is more lax in its manner of growth.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella (Polypora) Lilæa.

PLATE XVIII, FIGS. 19-22.

Polypora Lilia, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 96. 1874.
Fenestella (Polypora) Lilæa, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 165. 1879.
" " " " Report of State Geologist for 1882. Expl. pl. 18, figs. 19, 20. 1883.
Retepora, n. sp., Hall. Report of State Geologist for 1882. Expl. pl. 18, figs. 21, 22. 1883.

Bryozoum probably infundibuliform, growing from a very thin spreading radicle, which merges into a slender pedicel above having a diameter of 1 mm. Branches moderately strong, rounded on the non-celluliferous face and marked by obscure striæ. Bifurcations frequent. Dissepiments strong, expanding at their junction with the branches; four in the space of 5 mm. Fenestrules oval, width generally one-half the length.

On the celluliferous face the branches are rounded or flattened, and the dissepiments rounded and depressed. Fenestrules of the same appearance as on the opposite face. Cell apertures in from two to four ranges, the marginal ranges opening laterally; twenty in the space of 5 mm. When the specimen is worn or macerated the cells are large, oval and in contact, and without a careful examination this feature might readily be mistaken for the normal condition of the fossil.

Width of branches just above the bifurcation .20 mm., increasing to .70 mm.; diameter of dissepiments .25 mm.

Formation and localities. Lower Helderberg group, Scoharie, and near Clarksville, N. Y.

Fenestella (Polypora) compacta.

PLATE XVIII, FIGS. 1-3; PLATE 22, FIGS. 4, 5.

Fenestella compacta, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 163. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 18, figs. 1-3. 1883.
In part *Fenestella (Hemitrypa) Nervia*. Hall. Report of State Geologist for 1882. Expl. pl. 22, figs. 1-6. 1883.

Bryozoum infundibuliform, compact. Branches on the non-celluliferous side moderately strong, rounded, marked by obscure, granulose striations. Bifurcations occurring at intervals of from 3 to 7 mm.; width of the interstices usually less than the narrower portion of the branches. Dissepiments strong, rounded, on a plane with the branches, seven or eight in the space of 5 mm. Fenestrules oval, width from one-half to three-fourths the length.

On the celluliferous face the branches are rounded, and the dissepiments angular, while the fenestrules appear much narrower than on the opposite face, the branches being, sometimes, nearly in contact. Cell apertures minute, circular, in two and three ranges, opening directly outward, from fifteen to seventeen in the space of 5 mm., separated by less than the diameter of an aperture: margins distinctly elevated, those of the lateral ranges indenting the borders of the fenestrules.

Width of branches .33 mm., increasing to .66 mm.; width of dissepiments from .25 to .33 mm.; length of fenestrules from .25 to .33 mm.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella (Polypora) Arta.

PLATE XVIII, FIGS. 4-7.

Fenestella Arta, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 163. 1879.
In part *Fenestella Arta*, Hall. Report of State Geologist for 1882. Expl. pl. 18, figs. 4-9. 1883.

Bryozoum infundibuliform. Branches on the non-celluliferous side very strong near the base, becoming more slender above; angular, usually straight; sometimes sinuous or zigzag and presenting an irregular appearance; bifurcating at intervals of 10 mm. or more. Width of the interstices less than that of the branches. Dissepiments strong, angular, expanded at their

junction and on the same plane with the branches; five in the space of 5 mm. Fenestrules oval, width generally about one-half the length. The specimens observed are without ornamentation.

On the celluliferous face the branches are usually rounded, becoming angular or carinated where there are two ranges of apertures. Dissepiments rounded, depressed. The fenestrules appear narrower than on the opposite face, the width frequently being not more than one-fourth the length. Cell apertures minute, in two and three ranges, opening directly outward; twenty-five in the space of 5 mm.; sometimes nearly in contact, usually distant about one-half the diameter of an aperture: margins strong, elevated, decidedly indenting the borders of the fenestrules.

Width of branch above a bifurcation, near the base of a bryozoum, .50 mm., increasing to nearly 1 mm.; at some distance above the width is .30 mm., increasing to .60 or .70 mm.; width of dissepiments .30 mm.; length of fenestrules .70 mm.

This species may be distinguished from *F.* (*P.*) *obliqua*, pl. xviii, figs. 8, 9, by its less robust appearance, the larger and more distant apertures, and the presence of a carina between the ranges of cell apertures.

Formation and locality. In the lower Helderberg group, Catskill creek, N. Y.

Fenestella (Polypora) obliqua, n. sp.

PLATE XVIII, FIGS. 8, 9.

In part *Fenestella arta*, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 163. 1879.
" " " " Report of State Geologist for 1882. Expl. pl. 18, figs. 4–9. 1883.

Bryozoum infundibuliform, compact, undulating. Branches strong, angular, straight, sinuous or zigzag, according to the arrangement of the dissepiments. Bifurcations frequent. Dissepiments strong, angular; six in the space of 5 mm. Fenestrules elongate-oval.

On the celluliferous face the fenestrules appear much narrower than on the opposite face, and the polyzoary presents a much more compact and rigid appearance. Cell apertures small, circular, in from two to four ranges;

twenty in the space of 5 mm.; distant less than the diameter of an aperture: margins strong, elevated, those of the marginal ranges indenting the borders of the fenestrules and giving to them a crenulated appearance.

Width of branches .40 mm., increasing to .75 mm.; diameter of dissepiments .40 mm.; length of fenestrules about .40 mm.

This species, in some respects, closely resembles *F.* (*P.*) *Arta*, to which it was formerly referred, but it has a more robust appearance, the cell apertures are more closely disposed, and the ranges are not separated by a carina.

Formation and locality. In the shaly limestone of the lower Helderberg group, on Catskill creek, Greene county, N. Y.

Fenestella (Polypora) paxillata.

PLATE XVIII, FIGS. 10-12.

Fenestella paxillata, Hall. Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 164. 1879.
" *papillata* (in error), Hall. Report of State Geologist for 1882. Expl. pl. 18, figs. 10–12. 1883.

Bryozoum observed only in fragments, the form is, therefore, not definitely known. On the non-celluliferous face the branches are slender, at first rounded, becoming flattened and concave for a short distance before bifurcating, and marked by fine striæ. Bifurcations distant. Dissepiments moderately strong, rounded, slightly depressed below the plane of the branches. Fenestrules sub-quadrangular; width from one-half to one-third the length.

On the celluliferous face the branches are rounded, the dissepiments sub-angular and very much depressed. The fenestrules appear of the same form as on the opposite face. Cell apertures minute, circular; fourteen in the space of 5 mm.; distant about the diameter of an aperture; disposed in from two to four ranges; two ranges occur only for a short distance above the bifurcation, while the greater portion of the branch is occupied by three ranges. The central range or ranges open directly outward, the outer ranges open laterally.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

Fenestella adornata, n. sp.

PLATE XXII, FIGS. 7, 8.

Fenestella, sp.† Hall. Report of State Geologist for 1882. Expl. pl. 22, figs. 7, 8. 1883.

Bryozoum infundibuliform. Branches moderately strong, gently rounded; very gradually and regularly increasing in size to the bifurcations, which are infrequent; marked by from two to three prominent, granulose striations. Width of interstices from one-half to two-thirds that of the branches. Dissepiments strong, width .40 mm., six in the space of 5 mm. Fenestrules regularly oval.

On the celluliferous face the branches are angular. The interstices appear narrower than on the opposite face. Dissepiments rounded, much depressed below the plane of the branches. Cell apertures small, circular; twenty in the space of 5 mm., disposed in two ranges, opening somewhat laterally: margins distinctly and equally elevated. Ranges of apertures separated by a narrow, slightly elevated carina.

Formation and locality. Lower Helderberg group, near Clarksville, N. Y.

ICHTHYORACHIS, McCoy. 1844.

Ichthyorachis Nereis.

PLATE XXII, FIGS. 19-21.

Ichthyorachis Nereis, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 98. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p 174. 1879.
" " " Report of State Geologist for 1882. Expl. pl. 22, figs. 19-21. 1883.

Zoarium plumose; midrib longitudinally striated, flattened on the non-celluliferous face and marked by a groove along the center. Lateral branches or pinnules slender, distant from each other about the width of the midrib. There are two rows of apertures on the pinnules and three or more on the midrib. The largest fragment observed has a length of 17 mm.; width of midrib .50 mm.; width of pinnules about .25 mm.

The specimens are poorly preserved, and the characters of the cell apertures are indistinctly shown.

Formation and locality. In the shaly limestone of the Lower Helderberg group, Schoharie, N. Y.

MONOTRYPA, Nicholson. 1879.

Monotrypa? spinosula, n. sp.

PLATE XVI, FIG. 25.

Species undetermined. Report of State Geologist for 1882. Expl. pl. 16, fig. 25. 1883.

Zoarium explanate. Cells polygonal; septa infrequent; diameter of cell apertures .25 mm. Surface marked by maculæ composed of cells of nearly twice the diameter of those on other portions of the zoarium. Centers of maculæ distant from each other 5 mm.

Formation and locality. Tentaculite limestone, Lower Helderberg group, Schoharie, N. Y.

Paleschara concentrica, n. sp.

PLATE XVI, FIG. 24.

Species undetermined. Report of State Geologist for 1882. Expl. pl. 16, fig. 24. 1883.

Zoarium foliate; cells polygonal, in contact; walls thin; diameter of apertures .40 mm.; disposed in a radiatingly concentric order.

This species may be distinguished from *P. incrustans* by the more regular arrangement of the cell apertures.

Formation and locality. Lower Helderberg group, Clarksville, N. Y.

TABLE OF FENESTELLIDÆ OF THE LOWER HELDERBERG GROUP.

Fenestella.

a. Simple angular branches with two ranges of cell apertures.

F. crebripora.
F. Junceus.
F. Cleia.
F. Hestia.
F. Æsyle.
F. Noe.
F. Spio.

b. Simple angular branches with three ranges of cell apertures just below the bifurcations of the branches.

F. Althæa.
F. Eudora.
F. stricta.
F. Idothea.

c. Branches with prominent nodes or carinæ.

F. Adraste.
F. Sylvia.
F. Philia.
F. Thyene.
F. Coronis.
F. Idalia.
F. quadrula.
F. adornata.

d. Unitrypa, *carinæ elevated, connected by simple bars.*

F. (U.) præcursor.
F. (U.) Nervia.
F. (U.) Nervia, var constricta.

e. Hemitrypa, *carinæ elevated, connected by alternating bars, forming an intermediate false crest.*

F. (H.) biserialis.
F. (H.) biserialis, var. exilis.

f. Polypora, *branches with three or more ranges of cell apertures.*

1. *Branches with two and three ranges of cell apertures—three ranges predominating.*

F. (P.) compressa.
F. (P.) Lilæa.
F. (P.) compacta.
F. (P.) arta.
F. (P.) obliqua.

2. *Branches with three and four ranges of cell apertures.*

F. (P.) paxillata.

UPPER HELDERBERG GROUP.

DESCRIPTIONS OF SPECIES.

TREMATOPORA (TREMATELLA) ANNULATA.

PLATE XXV, FIGS. 22, 23; AND PLATE XXVI, FIGS. 1, 2.

Trematopora annulata, HALL. Trans. Albany Institute, vol. x, abstract, p. 5. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 24, figs. 1, 2. 1883.
Trematella " " Report of State Geologist for 1885, advance sheets. Expl. pl. 25, figs. 22, 23. 1886.

ZOARIUM ramose, solid; branches from 2 to 3 mm. in diameter; bifurcations occurring at intervals of from 4 to 15 mm. Cells tubular, arising from the center of the branch and regularly curving to the surface; in contact for the greater portion of their length; diverging and leaving a short intercellular space as they approach the surface; septate, septa closely disposed. Cell apertures polygonal, diameter .25 mm.; irregularly disposed, usually in contact, frequently with small spinules at the angles. Pseudopores small, infrequent. Monticules elongate, transverse to the branch; two or more are usually in the same line giving to the branch an annulated appearance. There is a narrow space along the middle of each monticule usually destitute of cell apertures, but frequently with small pits or pseudopores.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

TREMATOPORA (TREMATELLA) ARBOREA.

PLATE XXV, FIGS. 16–21.

Trematopora arborea, HALL. Trans. Albany Institute, vol. x, abstract, p. 5. 1881.
Trematella " " Report of State Geologist for 1885, advance sheets. Expl. pl. 25, figs. 16–21. 1886.

ZOARIUM ramose, solid; branches from 2 to 3 mm. in diameter; bifurcations occurring at intervals of from 2 to 7 mm. Cells tubular, polygonal, gradu-

ally diverging until near the surface, when they abruptly turn outward; septa infrequent. Cell apertures oval, length about .22 mm., width from one-half to two-thirds the length; closely and irregularly disposed. Interapertural space spinulose. The branches, when in a perfect condition, are covered by closely arranged aculeate processes. Many of the branches are annulated, but this feature is not constant.

In some varieties this species resembles *Trematopora* (*Trematella*) *annulata*, but may be distinguished by the oval cell apertures.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Trematopora (Trematella) glomerata.

PLATE XXV, FIGS. 4, 5.

Trematella glomerata, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 25, figs. 4, 5. 1886.

Zoarium ramose, solid; branches from 1.50 to 2 mm. in diameter; bifurcations frequent. Cells tubular, in contact for the greater portion of their length, slightly diverging as they approach the surface; septa infrequent or wanting. Intercellular space apparently solid. Cell apertures usually oval or circular, length .30 mm.; closely and irregularly disposed. Interapertural area elevated, angular or nodulose. Pseudopores variable in number on different portions of the frond, generally infrequent.

Formation and locality. Upper Helderberg group, Onondaga Valley, N. Y.

Trematopora (Orthopora) scutulata.

PLATE XXVI, FIGS. 7, 8.

Trematopora scutulata, Hall. Trans. Albany Institute, vol. x, abstract, p. 6. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 24, figs. 7, 8. 1883.

Zoarium ramose, solid; branches widely diverging, 1 mm. in diameter; bifurcations frequent. Cell apertures oval, length .25 mm., width .18 mm.; disposed in longitudinal parallel rows, alternating, forming oblique transverse rows, the latter arrangement being the most conspicuous: peristomes thin, inclosing a rhomboidal area, with a minute spinule at each angle.

This species closely resembles *T. (O.) rhombifera*, but the apertures are comparatively larger, more closely disposed, and the branches have a more delicate appearance.

Formation and localities. Upper Helderberg group, near Waterville, and Onondaga valley, N. Y.

Trematopora (Orthopora) regularis.

PLATE XXV, FIGS. 27, 28; AND PLATE XXVI, FIGS. 5, 6.

Trematopora regularis, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 105. 1874.
Orthopora " " Report of State Geologist for 1885, advance sheets. Expl. pl. 25, figs. 27, 28. 1886.

The specimens from the Upper Helderberg group, referred to this species, present essentially the same characters as those of the Lower Helderberg group, described on page 16.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Trematopora (Orthopora) rhombifera.

PLATE XXV, FIG. 29; AND PLATE XXVI, FIGS. 3, 4.

Trematopora rhombifera, Hall. Twenty-sixth Rept. N. Y. State Mus. Nat. Hist., p. 106. 1874.
Orthopora " " Report of State Geologist for 1885, advance sheets. Expl. pl. 25, fig. 29. 1886.

The specimens from this horizon present essentially the same characters as the forms of the Lower Helderberg group, described on page 18.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

TROPIDOPORA, Hall. 1886.

Tropidopora nana.

PLATE XXV, FIGS. 25, 26.

Tropidopora nana, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 25, figs. 25, 26. 1886.

Zoarium ramose, solid; branches .60 mm. in diameter Cell apertures broadly oval or circular, diameter .16 mm.; disposed in irregular longitudinal rows, which are separated by sinuous ridges: peristomes very thin, slightly elevated.

The interior of this species has not been studied, but the exterior characters are so different from other Trematoporoid forms that there seems a necessity of separating it as a distinct genus.

Formation and locality. Upper Helderberg group, Onondaga Valley, N. Y.

DIAMESOPORA, Hall. 1852.

Diamesopora camerata.

PLATE XXVI, FIGS. 9, 10.

Trematopora camerata, Hall. Report of State Geologist for 1882. Expl. pl. 24, figs 9, 10. 1883.

Zoarium ramose, hollow; branches 1.50 mm. in diameter; thickness of polyzoary .50 mm. Cell apertures usually circular or slightly oval, sometimes arched, diameter .33 mm.; generally irregularly disposed, but sometimes forming indistinct transverse rows. Anterior portion of peristome slightly elevated, posterior margin strongly elevated, oblique.

This species may be distinguished by its hollow cylindrical stems and very oblique, somewhat scattered cell apertures.

Formation and locality. Upper Helderberg group, near Caledonia, N. Y.

ACANTHOCLEMA, Hall. 1886.

Acanthoclema alternatum.

PLATE XXV, FIGS. 8-10.

Trematopora alternata, Hall. Trans. Albany Institute, vol. x, abstract, p. 6. 1881.
Acanthoclema " " Report of State Geologist for 1885, advance sheets. Expl. pl. 25, figs. 8–10. 1886.

Zoarium ramose, solid; branches slightly more than 1 mm. in diameter. Cells tubular, arising from a slender central axis, in contact for a little more than one-half their length. Cell apertures oval, length about .20 mm., width two-thirds the length; disposed in longitudinal parallel rows, ten rows on a branch, separated by strong longitudinal ridges, which are frequently granulose: peristomes thin, scarcely elevated. Between each two adjacent apertures, in the longitudinal direction, there is a prominent spiniform conical node.

The characteristic features of the surface are the longitudinal ridges alternating with the rows of nodes.

Formation and locality. Upper Helderberg group, Onondaga Valley, N. Y.

Acanthoclema ovatum.

PLATE XXVIII, FIG. 3.

Trematopora, sp. undt., Hall. Report of State Geologist for 1882. Expl. pl. 25, fig. 3. 1883.

Zoarium ramose, solid; diameter 1 mm.; bifurcations infrequent. Cell apertures oval, length .22 mm., width one-half the length; disposed in longitudinal parallel rows; twelve rows in the circumference of a branch, separated by narrow, slightly elevated ridges.

Formation and locality. Upper Helderberg group, Onondaga Valley, Onondaga county, N. Y.

Acanthoclema divergens.

PLATE XXVIII, FIG. 2.

Trematopora? sp. undt., Hall. Report of State Geologist for 1882. Expl. pl. 25, fig. 2. 1883.

Zoarium ramose, solid; branches .60 mm. in diameter, diverging at an angle of ninety degrees; bifurcations infrequent. Cell apertures oval, length .24 mm., width about one-half the length; disposed in longitudinal parallel rows; six rows in the circumference of a branch, separated by narrow, slightly elevated ridges.

This species closely resembles *A. triseriale*, but the cell apertures are proportionally much larger. A critical comparison shows this form to be quite distinct from the preceding (*A. ovatum*), with which it had been united in the previous descriptions.

Formation and locality. Upper Helderberg group, Onondaga Valley, Onondaga county, N. Y.

Acanthoclema triseriale.

PLATE XXVIII, FIGS. 5, 6.

Stictopora triserialis, Hall. Report of State Geologist for 1882. Expl. pl. 25 (xxviii), figs. 5, 6. 1883.

Zoarium ramose, solid; diameter .50 mm.; bifurcations infrequent. Cell apertures oval, length .15 mm., width from one-half to two-thirds the length; disposed in longitudinal parallel rows; six rows in the circumference of a branch, separated by comparatively prominent ridges.

This species may be distinguished by its slender branches, and minute cell apertures.

Formation and locality. Upper Helderberg group, near Caledonia, N. Y.

NEMATAXIS, Hall. 1886.

Nemataxis fibrosus.

PLATE XXV, FIGS. 30-36.

Nemataxis fibrosa, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 25, figs. 30-36. 1886.

Zoarium ramose, solid; branches 4 mm. in diameter; bifurcations comparatively frequent. Cells tubular, polygonal, arising from a central filiform axis, diverging at an angle of forty-five degrees until within a short distance from the surface, when they abruptly turn outward. Cell walls in contact for nearly their entire length. Cell apertures oval, length .30 mm., width about one-half the length; closely disposed in longitudinal parallel rows, separated by prominent ridges; about thirty rows on a branch: peristomes very thin, slightly elevated. At intervals of 3 mm. the surface is marked by monticules which are destitute of cell apertures, and extend across the branch, giving it an annulated appearance. The cell apertures are frequently obsolete, the surfaces being occupied by prominent longitudinal ridges.

In a fractured specimen, near the base, exposing the interior below the surface, the stipe exhibits a compact fibrous texture.

Formation and locality. Upper Helderberg group, Ontario, Canada.

CALLOPORA, HALL. 1852.

CALLOPORA MULTISERIATA.

PLATE XXV, FIGS. 6, 7; AND PLATE XXVI, FIGS. 18, 19.

Callopora multiseriata, HALL. Trans. Albany Institute, vol. x, abstract, p. 7. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 24, figs. 18, 19. 1883.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 25, figs. 6, 7. 1886.

ZOARIUM ramose, solid; branches 2 mm. in diameter. Cell apertures oval, length .33 mm., width two-thirds the length; irregularly disposed, distance from each other varying from contact to a little more than the width of an aperture: margins very thin, not elevated. Mesopores elongate, arranged in longitudinal rows, giving to the surface of the branches a striated appearance.

This species may be distinguished from *C. geniculata* by the elongate mesopores and striated appearance of the surface.

Formation and locality. Upper Helderberg group, Warner's Quarry, south of Le Roy, N. Y.

CALLOPORA GENICULATA.

PLATE XXV, FIGS. 1-3.

Callopora geniculata, HALL. Report of State Geologist for 1885, advance sheets. Expl. pl. 25, figs. 1-3. 1886.

ZOARIUM ramose, solid; branches 1.50 mm. in diameter; bifurcations frequent. Cells tubular, gradually enlarging. Cell apertures oval, length .33 mm., width two-thirds the length; usually irregularly disposed, and sometimes having an indistinct longitudinal arrangement: margins moderately strong, not elevated. Mesopores minute, from one to three series between adjacent cell apertures. Surface without maculæ.

Formation and locality. Upper Helderberg group, Ontario, Canada.

CŒLOCAULIS, Hall.

Callopora (Cœlocaulis) aculeolata.

PLATE XXVI, FIGS. 16, 17.

Callopora aculeolata, Hall. Trans. Albany Institute, vol. x, abstract, p. 7. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 24, figs. 16, 17. 1883.

Zoarium ramose, hollow; branches from 2.50 to 3 mm. in diameter. Cell apertures oval, length .50 mm., width from one-half to three-fourths the length; irregularly disposed, frequently in contact: peristomes moderately strong, equally elevated, with from one to three conical nodes. Mesopores minute, indistinct; margins thin, slightly elevated.

Formation and locality. Upper Helderberg group, N. Y.

Callopora (Cœlocaulis) irregularis.

PLATE XXVI, FIGS. 11-15.

Callopora irregularis, Hall. Trans. Albany Institute, vol. x, abstract, p. 7. 1881.
In part *Trematopora (Callopora) irregularis*, Hall. Report of State Geologist for 1882. Expl. pl. 24, figs. 11–15. 1883.

Zoarium ramose, hollow; branches from 2 to 3 mm. in diameter. Cell apertures circular, irregularly disposed, diameter .33 mm.: peristomes strong, distinctly and equally elevated. Mesopores large, indistinct, frequently obsolete. Peristomes and surface finely granulose.

Formation and locality. Upper Helderberg group, Central New York.

Callopora (Cœlocaulis) Hyale.

PLATE XII, FIGS. 18, 19.

Callopora Hyale, Hall. Twenty-sixte Rept. N. Y. State Mus. Nat. Hist., p. 100. 1874.
" " " Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 155. 1870.
" " " Report of State Geologist for 1882. Expl. pl. 12, figs. 18, 19. 1883.

Zoarium ramose, hollow, thickness .60 mm.; branches 5 mm. in diameter. Cell apertures obscurely trilobote, diameter .33 mm., irregularly disposed; distant less than the diameter of an apertures. Peristomes strong, equally elevated. Mesopores minute, two or three series between adjacent apertures. Surface marked by frequent maculæ destitute of cell apertures.

This species may be distinguishrd from *C.* (*C.*) *irregularis* by its trilobate cell apertures and minute mesopores.

The original specimen of this species was supposed to be derived from the Lower Helderberg group, near Clarksville, N. Y., but a more careful examination has shown that it is from the shaly layers of the Upper Helderberg group in the central part of the State.

Formation and locality. Upper Helderberg group, Central New York.

LICHENALIA, HALL. 1852.

LICHENALIA LUNATA.

PLATE XXXI, FIGS. 1-9.

Fistulopora lunata, ROMINGER. Proc. Acad. Nat. Sci. Phila., abstract, p. 7. 1866.
Lichenalia lunata, HALL. Trans. Albany Institute, vol. x, abstract, p. 10. 1881.
Buscopora dentata, ULRICH. Cont. Am. Pal., vol. i, p. 22. Pl. 2, figs. 5, 5*a*. 1886.
Lichenalia lunata, HALL. Report of State Geologist for 1885. Expl. pl. 31, figs. 1-9. 1887.

ZOARIUM consisting of lamellate expansions, free or encrusting other objects, thickness from 1 to 5 mm. Cells tubular, oblique to the surface; septate, septa frequent. Cell apertures lunate or sub-circular, width .36 mm., oblique; very closely and usually irregularly disposed, sometimes forming diagonally intersecting rows; without elevated margins. On the posterior portion of the aperture are two very narrow, prominent denticulations, which in the course of growth form two striations along the inner face of the cell wall. On the surface, at intervals of about 4 mm., occur maculæ, which are slightly elevated or flat, and destitute of cell apertures. The apertures adjacent to these do not radiate from them and are not larger than the others.

On some specimens where the surface has been abraded the mouths of the cells appear as sub-circular or circular apertures, with thin, equally elevated margins, distant from each other the diameter of an aperture or more. Intercellular structure composed of irregular vesicles or minute septate tubuli; both forms of structure sometimes occurring in the same frond.

On account of the tooth-like processes and accessory cells, Mr. Ulrich has proposed for this species the generic designation of BUSCOPORA. The denticula-

tions though very narrow frequently preserve the crescentic appearance common to the denticulations of many other species. The gradation through various species from this form of denticulation to the wide crescentic form is very gradual. Many specimens have been examined, but I have been unable to discover the accessory cells mentioned by Mr. Ulrich as constituting a distinctive character.

Formation and localliy. Upper Helderberg group, Falls of the Ohio river.

LICHENALIA LUNATA, var. TUBULATA.

PLATE XXXI, FIGS. 28, 29.

Lichenalia lunata, var. *tubulata*, HALL. Report of State Geologist for 1885. Expl. pl. 31, figs. 28, 29 1887.

THIS associated variety differs from ordinary forms of *L. lunata*, in its tubular mode of growth.

LICHENALIA SUBSTELLATA.

PLATE XXVI, FIG. 26; AND PLATE XXX, FIGS. I–II.

Lichenalia substellata, HALL. Trans. Albany Institute, vol. x, abstract, p. 7. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 24, fig. 26. 1883.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 30, figs. 1–11. 1886.
? *Fistulipora normalis*, ULRICH. Cont. Am. Pal., vol. i, No. 1, p. 20. 1886.

ZOARIUM consisting of lamellate expansions, or of masses formed by the superimposition of successive layers of irregular growth, frequently contorted. Cells cylindrical, usually at right angles to the surface; septa infrequent or wanting. Cell apertures circular, diameter .33 mm.; closely and irregularly disposed: peristomes strong, generally the posterior portion is the more distinctly elevated, oblique, and occasionally denticulated. Surface marked by flat or slightly elevated substellate non-celluliferous maculæ, the centers of which are distant from each other about 4 mm. The apertures immediately adjacent to these are radiatingly disposed, larger and more oblique than on other portions of the frond. Intercellular space, near the base, occupied by irregular vesicles, above by septate tubuli; from five to eight septa in the space of 1 mm. Occasionally the apertures are operculate,

sometimes entirely covered by an organic deposit, and presenting a pustuliform aspect.

This species can be easily distinguished by the numerous, conspicuous, substellate maculæ.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Lichenalia bistriata.

PLATE XXXII, FIGS. 6-14.

Lichenalia bistriata, Hall. Trans. Albany Institute, vol. x, abstract, p. 8. 1881.
" " " Report of State Geologist for 1885. Expl. pl. 23, figs. 6-14. 1887.

Zoarium lamellate, free or encrusting. Cell tubes without septa. Apertures lunate or semi-circular, diameter .40 mm. Anterior portion of the peristomes very slightly elevated; posterior portion strongly elevated, projecting over and partially concealing the opening, which is margined by two slight denticulations. When the surface is worn or macerated the elevated margins become obsolete, the apertures appearing simply as lunate or semi-circular openings. Surface with slightly elevated maculæ, the centers of which are without cell apertures, the apertures adjacent to these radiate from them and are more oblique than the others. Intercellular space septate.

This species resembles *L. lunata*, but may be distinguished by the strongly elevated cell margins, and the absence of septa in the cell tubes.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Lichenalia geometrica.

PLATE XXXII, FIGS. 21-23.

Lichenalia geometrica, Hall. Report of State Geologist for 1885. Expl. pl. 32, figs. 21-23. 1887.

Zoarium consisting of very thin lamellate expansions, incrusting other objects. Cell apertures oblique, sub-triangular, diameter .30 mm.; irregularly disposed; posterior margin very strongly elevated, oblique, angular. Surface with maculæ, the centers of which are distant from each other about 5 mm.; the cells immediately adjacent and radiating from them, are larger and more

oblique than the others; the posterior or upper portions of the walls are exposed for nearly their entire length, being more or less distinctly carinate. There are slightly elevated, transverse ridges between the larger cells, giving to the maculæ a geometrical appearance.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

LICHENALIA OVATA.

PLATE XXXII, FIGS. 1-5.

Lichenalia ovata, HALL. Report of State Geologist for 1885. Expl. pl. 32, figs. 1-5. 1887.

ZOARIUM consisting of lamellate expansions, free or encrusting. Thickness of specimens observed 2 mm. Cells tubular, cylindrical, at right angles to the surface; septa wanting. Apertures broadly ovate and sometimes trilobate, length .40 mm., width three-fourths the length; radiating from maculæ. Posterior margin of peristomes strongly elevated, oblique, frequently with two slight denticulations. Surface with substellate maculæ destitute of cell apertures, the centers of which are distant from each other about 5 mm., diameter 2 mm.; adjacent apertures not larger than the others. Intercellular space regularly septate, septa distant.

This species closely resembles *L. substellata*, but may be distinguished by its larger, more ovate cell apertures, and the absence of septa in the cell tubes; from *Lichenalia* (*Odontotrypa*) *alveata* by its less closely arranged, ovate cell apertures, well defined apertural margins, and its thicker fronds.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

LICHENALIA ALTERNATA.

PLATE XXXI, FIGS. 39-41.

Lichenalia alternata, HALL. Trans. Albany Institute, vol. x, abstract, p. 8. 1881.
" " " Report of State Geologist for 1885. Expl. pl. 31, figs. 39-41. 1887

ZOARIUM consisting of very thin lamellate expansions, incrusting other objects. Cell apertures oval, length about .35 mm., width from one-half to two-thirds the length; closely disposed, frequently alternating and sub-imbricating. Pos-

terior margin of peristomes strongly elevated, oblique. Surface marked by slightly elevated monticules, the centers of which are distant from each other about 5 mm.; the apertures on these are of the same size and have the same direction as the others. Intercellular space vesiculose.

This species may be distinguished by the large, oval, sub-imbricating cell apertures having the same general direction, and not interrupted by the monticules.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

LICHENALIA CONULATA.

PLATE XXXI, FIGS. 10–14.

Lichenalia conulata, HALL. Trans. Albany Institute, vol. x, abstract, p. 9. 1881.
" " " Report of State Geologist for 1885. Expl. pl. 31, figs. 10–14. 1887.

ZOARIUM ramose, hollow; diameter of frond 15 mm.; thickness from 2 to 5 mm. Cells tubular, at right angles to the surface; septa strong, frequent. Apertures circular, papilliform, diameter of opening .20 mm., including margins .33 mm.; irregularly disposed, generally in contact: peristomes strong, converging, posterior portion the most prominent. Monticules conical, height 1.50 mm., centers distant from each other 5 mm., bases in contact. Cell apertures at center of monticules ovoid. Intercellular space near base irregularly vesicular, above regularly septate.

This species can be readily distinguished by the papilliform cell apertures, and prominent conical monticules.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

LICHENALIA SUBCAVA.

PLATE XXVI, FIGS. 23–25.

Lichenalia subcava, HALL. Trans. Albany Institute, vol. x, abstract, p. 8. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 24, figs. 23–25. 1883.

ZOARIUM lamellate. Cells at right angles to the surface. Apertures sub-triangular, diameter .20 mm., irregularly disposed. Anterior margin obso-

lete; posterior margin strongly elevated, slightly denticulated, projecting over and partially concealing the opening. The surface contiguous to the posterior margin is convex, giving to the apertures the appearance of small openings in the side of a rounded elevation. Monticules destitute of cell apertures, their centers distant from each other about 4 mm. Intercellular space occupied by irregular vesicles or septate tubuli; space beneath monticules without interior structure.

This species may be distinguished by the hemispherical monticules and the sub-imbricating appearance of the cell apertures.

Formation and locality: Upper Helderberg group, Falls of the Ohio river.

Lichenalia permarginata.

PLATE XXVI, FIG. 20.

Lichenalia permarginata, Hall. Trans. Albany Institute, vol. x, abstract, p. 10. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 24, fig. 20. 1883.

Zoarium consisting of lamellate expansions; thickness of the specimens observed .50 mm. Cell apertures circular, diameter .40 mm.; irregularly and not closely disposed: peristomes strong, distinctly and equally elevated. Surface marked by non-celluliferous maculæ, which are distant from each other .7 mm.; the apertures immediately adjacent being slightly larger than on other portions of the frond. Surface where well preserved finely granulose.

Formation and locality. Upper Helderberg group, Onondaga Valley, Onondaga county, N. Y.

Pileotrypa, s. g.

Lichenalia (Pileotrypa) pyriformis.

PLATE XXXI, FIGS. 21–27.

Lichenalia pyriformis, Hall. Trans. Albany Institute, vol. x, abstract, p. 12. 1881.
" *(Pileotrypa) pyriformis.* Report of State Geologist for 1885. Expl. pl. 31, figs. 21–27. 1887.

Zoarium consisting of thin lamellate expansions incrusting other objects. On the thinner portions of the frond the cells are very oblique, sometimes a portion of the walls being exposed for nearly the entire length, presenting a pyri-

form appearance; on the thicker portions of the frond the cells are slightly oblique or at right angles to the surface. Apertures sub-circular, trilobate, diameter .33 mm., margins parallel with the surface; separated from each other by a space equal to or greater than their own diameter; usually alternating and frequently imbricating. On the thinner part of the frond the anterior portion of the peristome is slightly, and the posterior portion very strongly, elevated; sometimes having a height of .40 mm. On the thicker portions of the frond the margins are nearly equally elevated. On the posterior margin are two prominent denticulations, which in the course of growth form two parallel striations along the interior of the cell wall. Surface with slightly elevated monticules, the centers of which are distant from each other 5 mm. Interapertural space bullate. Intercellular space vesiculose.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Lichenalia (Pileotrypa) clivulata.

PLATE XXXI, FIGS. 30-32.

Lichenalia clivulata, Hall. Trans. Albany Institute, vol. x, abstract, p. 9. 1881.
" (*Pileotrypa*) *clivulata*. Report of State Geologist for 1885. Expl. pl. 31, figs. 30–32. 1887.

Zoarium tubular or ramose, hollow. In the specimen described the diameter of the frond is 8 mm., thickness of zoarium about 1 mm. Cells tubular, at right angles to the surface; without septa. Apertures trilobate, length of opening .15 mm., width two-thirds the length; radiating, closely disposed, not in contact. Posterior portion of peristomes strongly elevated, denticulated, projecting over and partially concealing the opening. Monticules rounded, centers distant 2 mm., bases in contact, a small space at the center smooth. The cell apertures radiate from the centers of the monticules, those immediately adjacent to them slightly larger than the others. Surface granulose. Intercellular space occupied by septate tubuli.

This species may be distinguished from *L.* (*P.*) *denticulata*, by the less crowded appearance of the cell apertures, less elevated posterior margin, slighter den-

ticulations, more closely arranged monticules, the space at their centers being without cell apertures.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Lichenalia (Pileotrypa) granifera.

PLATE XXX, FIGS. 28-31.

Lichenalia granifera, Hall. Trans. Albany Institute, vol. x, abstract, p. 11. 1881.
" (*Pileotrypa*) *granifera*. Report of State Geologist for 1885, advance sheets. Expl. pl. 30, figs. 28-31. 1886.

Zoarium consisting of lamellate expansions, greatest thickness observed 1.50 mm. Cell tubes at right angles to the surface, often with frequent constrictions; septa occurring at short intervals. Cell apertures ovate, length .35 mm., width from one-half to two-thirds the length; closely and irregularly disposed. Anterior margin of peristome thin and slightly elevated; posterior portion strongly elevated; denticulations slight or wanting. Maculæ destitute of cell apertures, distant from each other 5 mm., diameter 1.50 mm.; the cells immediately adjacent radiate from them, and are larger than the others. Intercellular space regularly septate. Surface granulose.

This species may be distinguished by the constrictions of the cell tubes, the ovate cell apertures, with strong posterior margins without denticulations, and the granulose surface.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Lichenalia (Pileotrypa) denticulata.

PLATE XXVI, FIGS. 21, 22, 26; AND PLATE XXX, FIGS. 12-20.

Lichenalia denticulata, Hall. Trans. Albany Institute, vol. x, abstract, p. 8. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 24, figs. 21, 22, 26. 1883.
" (*Pileotrypa*) *denticulata*. Report of State Geologist for 1885, advance sheets. Expl. pl. 30, figs. 12-20. 1886.
Compare *Eridopora minima*, Ulrich. Cont. Am. Pal., vol. i, No. I, p. 21, pl. 2, fig. 6, 6*a*. 1886.

Zoarium consisting of thin lamellate expansions, encrusting other objects. Cell apertures trilobate, length .25 mm.; crowded and irregularly disposed. Anterior margin of peristome slightly elevated; posterior portion denticulate

and very strongly elevated, projecting over and partially concealing the apertures. Monticules distinctly elevated, the centers distant from each other about 3 mm., bases in contact. Near the center of the monticules the cell apertures present a somewhat confused appearance. Intercellular space occupied by septate tubuli.

This species can be easily distinguished by the crowded appearance of the cell apertures, and their very prominent, denticulated posterior margins.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Odontotrypa, s. g., Hall. 1886.

Lichenalia (Odontotrypa) alveata.

PLATE XXX, FIGS. 24–27.

Lichenalia alveata, Hall. Trans. Albany Institute, vol. x, abstract, p. 10. 1881.
" *(Odontotrypa) alveata.* Report of State Geologist for 1885, advance sheets. Expl. pl. 30, figs. 24–27. 1886.

Zoarium consisting of very thin expansions. Cells oblique, frequently imbricating. Apertures oblique to the surface, trilobate, diameter .40 mm.; irregularly and very closely arranged, generally in contact. Peristomes thin, anterior portion slightly elevated; posterior portion more strongly elevated, and having two prominent denticulations, producing a cresentic projection. Surface with maculæ destitute of cell apertures, depressed, elongate, length 4 mm., width 1 mm. Intercellular space vesiculose.

This species may be distinguished by its large, closely arranged, imbricating cells, and elongate, depressed maculæ.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Glossotrypa, s. g., Hall. 1887.

Lichenalia ? (Glossotrypa) paliformis.

PLATE XXXI, FIGS. 15–18.

Lichenalia paliformis, Hall. Trans. Albany Institute, vol. x, abstract, p. 11. 1881.
" *(Glossotrypa) paliformis.* Report of State Geologist for 1885. Expl. pl. 31, figs. 15–18. 1887.

Zoarium tubular, cylindrical; diameter of frond 2 mm.; thickness of zoarium .40 mm. Cells tubular, with frequent narrow projections (semi-diaphragms) from the

cell walls, extending partially across the tube. Apertures paliform, diameter .20 mm.; very closely disposed, frequently in diagonally intersecting rows, the surface presenting a reticulated appearance. Surface between apertures elevated, forming ridges; frequently a prominent node at the intersection of the ridges, sometimes a depression or pit. Surface with prominent monticules, which are transversely in contact, and longitudinally distant about 2 mm., giving to the frond an annulated appearance. Intercellular structure vesiculose.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

SELENOPORA, s. g., Hall. 1886.

Lichenalia (Selenopora) circincta.

PLATE XXV, FIGS. 13-15.

Lichenalia circincta, Hall. Trans. Albany Institute, vol. x, abstract, p. 11. 1881.
Selenopora " " Report of State Geologist for 1885, advance sheets. Expl. pl. 25, figs. 13-15. 1886.

Zoarium consisting of very thin lamellate expansions, encrusting other objects. Cells oblique, frequently alternating and imbricating. Apertures circular or broadly oval, diameter .10 mm.: anterior margin of peristome slightly elevated; posterior portion strongly elevated, denticulated, projecting over and partially concealing the opening. The posterior portions of the peristomes are connected by oblique walls which traverse the surface between the apertures, uniting and forming polygonal vestibular areas. Maculæ distant from each other 4 mm., consisting of circular spaces, destitute of apertures, having a diameter slightly less than 1 mm.; the cells immediately adjacent, radiating from them, being larger and more oblique than on other portions of the frond.

This species may be distinguished from *S. complexa* by its much smaller cell apertures and vestibular areas.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Lichenalia (Selenopora) complexa.

PLATE XXXI, FIGS. 19, 20.

Lichenalia complexata (by error), Hall. Trans. Albany Institute, vol. x, abstract, p. 11. 1881.
Pelenopora complexa. Report of State Geologist for 1885. Expl. pl. 31, figs. 19, 20. 1887.

The manner of growth of this species is the same as that of *S. circincta*, but the cell apertures and vestibular areas are very much larger. Diameter of areas .66 mm., of cell apertures .25 mm.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fistulipora lamellata.

PLATE XXX, FIGS. 21–23.

Thallostigma lamellata, Hall. Trans. Albany Institute, vol. x, abstract, p. 13. 1881.
Fistulipora " Report of State Geologist for 1885, advance sheets. Expl. pl. 30, figs. 21–23. 1886.

Zoarium consisting of very thin lamellate expansions. Cell apertures generally circular, sometimes oval, diameter .36 mm.; irregularly disposed, somewhat distant. Peristomes strong, distinctly and equally elevated. Surface marked by maculæ, which are destitute of cell apertures, and distant from each other about 5 mm.; the apertures immediately adjacent to these are larger than the others. Mesopores minute, indistinct, margins very slightly elevated.

This species may be distinguished from *Lichenalia permarginata* by the much smaller, more closely arranged cell apertures, and by the presence of mesopores; from *F. scrobiculata* of the Hamilton group, by its somewhat larger cell apertures and very minute mesopores.

Formation and locality. Upper Helderberg group, Onondaga Valley, Onondaga county, N. Y.

Fistulipora intercellata.

PLATE XXXII, FIGS. 15–20.

Thallostigma intercellata, Hall. Trans. Albany Institute, vol. x, abstract, p. 13. 1881.
Fistulipora " Report of State Geologist for 1885. Expl. pl. 32, figs. 15–20. 1887.

Zoarium consisting of thin lamellate expansions incrusting other objects. Cells tubular, at right angles to the surface, without septa. Apertures oval, length

.25 mm., width two-thirds the length; irregularly disposed, frequently in contact. Peristomes strong, equally elevated, sometimes with one or two comparatively strong nodes or spinules. Mesopores minute, usually only one series between adjacent apertures; margins the same height as those of the peristomes. Intercellular space vesiculose.

This species may be distinguished from *F. digita*, of the Hamilton group, by its manner of growth, that species being always more or less digitate, the less closely disposed apertures and the absence of numerous spinules; from *F. striata*, it differs in its much smaller mesopores, those of that species sometimes obscuring the apertures; from *F. multiaculeata*, it differs in having the apertures smaller, more broadly oval, and without the numerous spinules characteristic of that species.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

COSCINIUM, Keyserling. 1846.

Coscinium striaturum.

PLATE XXXIII, FIGS. 20, 21.

Clathropora striatura. Hall. Report of State Geologist for 1882. Expl. pl. 26, figs. 20, 21. 1883.

Zoarium consisting of lamellate expansions, celluliferous on each side; perforated at regular intervals by oval fenestrules. Cell apertures oblique, subtriangular, diameter .18 mm.; closely disposed, frequently alternating and imbricating: anterior portion of the peristome not elevated; posterior portion strongly elevated, projecting over and partially concealing the opening, and having two slight denticulations. Fenestrules oval, length about 2 mm., usually occurring at intervals of about 4 mm.; disposed in diagonally intersecting rows. There is a space around each fenestrule destitute of apertures, much wider at the lower part of the fenestrule than above, and with low, broad ridges. The general direction of the cells is not interrupted by the fenestrules.

This species is easily distinguished from *Coscinotrypa carinata* by the absence of lateral growths, and the general direction of the cells not being interrupted by the fenestrules.

Formation and locality. Upper Helderberg group, Stafford, N. Y.

COSCINOTRYPA, Hall. 1886.

Coscinotrypa cribriformis, var. carinata.

PLATE XXIX, FIGS. 29–35; AND PLATE XXXIII, FIGS. 22–25.

Coscinium cribriformis. Prout. Trans. St. Louis Acad. Sci., vol. 1, No. 2, p. 269, pl. 16, figs. 1, 1*a*. 1858.
Clathropora carinata, Hall Report of State Geologist for 1882. Expl. pl. 26, figs. 22–25. 1883.
Coscinotrypa " " Report of State Geologist for 1885, advance sheets. Expl. pl. 29, figs. 29–35. 1886.

Zoarium consisting of explanate fronds, celluliferous on both faces, with perforations or fenestrules at varying distances from each other. At unequal intervals the surface is raised into angular folds or plications, which continue growth in the same manner, and in a direction at right angles to the parent frond; these in turn giving rise to similar elevations. Cells tubular, very oblique, slightly curved, arising from a mesotheca. Cell apertures trilobate, diameter .20 mm.; sometimes when macerated appearing arched or sub-triangular; very closely and usually irregularly disposed, but sometimes alternating and sub-imbricating. The apertures adjacent to the fenestrules invariably radiate from them. At the posterior margin of the apertures there are strong crescentic denticulations, which in the course of growth form two parallel ridges along the interior of the cell wall. Fenestrules circular or oval; diameter from 1.50 to 2 mm., distant from each other from 2 to 5 mm.; a space, .75 mm. wide, around each fenestrule destitute of cell apertures. Intercellular space vesiculose. The variation in the size and distance from each other of the fenestrules is so great, that frequently the extremes have only a generic resemblance. In some fronds the fenestrules are small, irregularly disposed, distant 5 mm. or more; in others they are large, closely disposed in regular intersecting rows; while in still others, or in portions of the fronds having small fenestrules, they are represented by maculæ destitute of cell apertures. All gradations may occur.

Two forms, from the Falls of the Ohio, have been described by Prout, as *Coscinium Keyserlingi* and *C. cribriformis;* the form here described is not *C. Keyserlingi*, but has been identified with *C. cribriformis*, which was based upon one of the many phases of the species as now recognized.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

STICTOPORA, HALL. 1847.

STICTOPORA GILBERTI.

PLATE XXVII, FIGS. 20-35; AND PLATE XXVIII, FIGS. 21, 22.

Ptilodictya (Stictopora) Gilberti, MEEK. Proc. Acad. Nat. Sci., Phila. 1871.
Stictopora Gilberti (MEEK), HALL. Trans. Albany Institute, vol. x, abstract, p. 13. 1871.
" " HALL. Report of State Geologist for 1882. Expl. pl. 25, figs. 21, 22. 1883.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 27, figs. 20-35. 1886.
Cystodictya Gilberti (MEEK), ULRICH. Journal Cincinnati Soc. Nat. Hist. Amer. Pal. Bryozoa. Pl. 2, fig. 5, 5*a*, 5*b*. 1884.

ZOARIUM consisting of a dichotomously branched frond, proceeding from a spreading base; transverse section lenticular, abruptly contracting to the margins; width of branches from 4 to 6 mm.; margins diverging; greatest thickness .75 mm., width of non-celluliferous margin slightly less than 1 mm.; bifurcations occur at intervals of from 5 to 10 mm. Cells tubular, length from 1.50 to 1.75 mm., for about one-half their length essentially parallel to the mesotheca, then turning abruptly outward. Cell apertures oval, length about .25 mm., width from one-half to three-fourths the length; the marginal apertures slightly larger than those on other portions of the frond; disposed in longitudinal rows, which increase by interstitial additions. Rows separated by prominent ridges, which sometimes have a depression along the middle. Peristomes strong, distinctly and equally elevated, each one with a defined lunate process, the extremities presenting two prominent denticulations, which in the course of growth form two parallel ridges on the inner surface of the cell walls. The denticulations are invariably situated on the outer margin of the aperture. Intercellular space irregularly vesicular.

This species may be distinguished from *Stictopora incissurata*, of the Hamilton group, by its frequent bifurcations and the rapid increase in width of the branches; these characters and its larger size distinguish it from *S. ovatipora;* it differs from *S. semistriata*, by its more frequent bifurcations, strong denticulations of the apertures, and more prominent continuous intercellular ridges.

Mr. Ulrich has founded the family CYSTODICTYONIDÆ on the characters presented by *C. ocellata*, but they are similar to those of all other species of STICTOPORA of which we have been able to observe the internal characters.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

STICTOPORA CRESCENS.

PLATE XXVII, FIGS. 5–11.

Stictopora crescens, HALL. Report of State Geologist for 1885, advance sheets. Expl. pl. 27, figs 5–11. 1886.

ZOARIUM consisting of a flattened, rigid, dichotomously branched frond; transverse section broadly lenticular, nearly oval; branches from 3 to 3.50 mm. wide, very gradually increasing in width; margins essentially parallel; greatest thickness 1.20 mm.; non-celluliferous margin with fine, oblique striations. Cells tubular, length about 1.20 mm., regularly curving to the surface. Cell apertures broadly oval, length from .25 to .33 mm., width three-fourths the length, sometimes nearly equal to it, marginal apertures larger than the others; all disposed in longitudinal parallel rows; about nine rows on each face of the branch; rows separated by prominent ridges. Peristomes thin, distinctly and equally elevated, apparently not denticulated. Intercellular space irregularly vesicular.

This species most closely resembles *S. rigida*, but is thicker, the non-celluliferous space at the margin of the branch is wider and striated, the ridges separating the ranges of apertures are rounded, those of *S. rigida* being acutely angular; the peristomes are equally elevated and without denticulations. From *S. fruticosa* it differs in its much fewer bifurcations and more rigid appearance; from *S. incissurata*, by its essentially parallel ranges of cell apertures.

Formation and locality. Upper Helderberg group, Ontario, Canada.

STICTOPORA RIGIDA.

PLATE XXVIII, FIGS. 15, 16.

Stictopora rigida, HALL. Trans. Albany Institute, vol. x, abstract, p. 14. 1881.
" " Report of State Geologist for 1882. Expl. pl. 25, figs. 15, 16. 1883.

ZOARIUM consisting of a flattened, rigid, dichotomously branching stipe; transverse section lenticular; width of branches from 2 to 3 mm., margins essen-

tially parallel; non-celluliferous space at the margin very narrow; greatest thickness .65 mm.; bifurcations infrequent. Cell apertures oval, length .25 mm., width from one-half to three-fourths the length; marginal apertures slightly larger than the others; all disposed in longitudinal parallel rows, which are separated by prominent, sharply angular, finely striated ridges. Peristomes thin, slightly and equally elevated; denticulated; denticulations moderately strong and situated on the posterior portion of the peristome.

This species may be distinguished from *S. crescens*, which it most nearly resembles, by the very narrow, smooth, non-celluliferous space at the margin, the angular longitudinal ridges, and the denticulations of the cell apertures. The position of the denticulations on the posterior portion of the aperture, will distinguish it from nearly all the denticulated forms.

Formation and locality. Upper Helderberg group, west of Le Roy, N. Y.

Stictopora fruticosa.

PLATE XXVIII, FIGS. 12–14.

Stictopora fruticosa, Hall. Trans. Albany Institute, vol. x, abstract, p. 14. 1881.
" " Report of State Geologist for 1882. Expl. pl. 25, figs. 12–14. 1883.

Zoarium consisting of a flattened, dichotomously branched, fruticose stipe; transverse section lenticular; width of branches from 2.50 to 3 mm., margins nearly parallel; greatest thickness from .80 to 1.20 mm. Cell apertures oval, length .40 mm., width one-third the length; marginal ones larger than the others; all disposed in parallel longitudinal rows, six or seven rows on each face of a branch. Surface between apertures obscurely striated, granulose, elevated, resembling ridges. Peristomes thin, slightly elevated, granulose, not denticulated.

The appearance of the surface varies according to the condition of the frond; when much weathered the apertures are enlarged, frequently polygonal, sometimes giving to the surface a reticulated appearance.

This species may be distinguished by the narrow elongate cell apertures, the granulose elevations between the ranges of apertures, and the frequent bifurcations, which give to the frond a fruticose appearance.

Formation and locality. Upper Helderberg group, N. Y.

STICTOPORA OVATIPORA.

PLATE XXVII, FIGS. 12-19; AND PLATE XXVIII, FIGS. 23, 23a.

Stictopora ovatipora, HALL. Trans. Albany Institute, vol. x, abstract, p. 14. 1881.
" " Report of State Geologist for 1882. Expl. pl. 25, figs. 23, 23 A. 1883.
" " Report of State Geologist for 1885, advance sheets. Expl. pl. 27, figs. 12-19. 1886.

ZOARIUM consisting of a dichotomously branching, flattened stipe; transverse section broadly lenticular; width of branches from 2 to 3 mm., margins essentially parallel; greatest thickness less than 1 mm. Cell apertures oval, length about .25 mm, width from one-half to two-thirds the length; marginal apertures larger than the others, and more nearly circular; disposed in longitudinal rows, increasing by interstitial addition. Rows separated by prominent ridges. Peristomes strong, distinctly and equally elevated, having two slight denticulations, which are invariably situated on the outer margin of the aperture. Intercellular space irregularly vesicular.

This species closely resembles *S. Gilberti*, but may be distinguished by its narrow branches with essentially parallel margins, which give to the frond a somewhat rigid appearance.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

STICTOPORA VERMICULA.

PLATE XXVII, FIGS. 2-4.

Stictopora vermicula, HALL. Report of State Geologist for 1885, advance sheets. Expl. pl. 27, figs. 2-4. 1886.

ZOARIUM consisting of a dichotomously branching and flattened stipe, of irregular appearance; transverse section sub-lenticular, abruptly narrowing and very thin near the margins; width of branches from 2.50 to 3 mm., margins slightly divergent; non-celluliferous space comparatively wide, flat; greatest thickness about .80 mm.; bifurcations frequent. Cells tubular, length about .80 mm., for a little more than one-half their length essentially parallel with the mesotheca, then abruptly turning outward. Cell apertures broadly oval or circular, frequently pustuliform, diameter from .25 to .30 mm., the marginal ones larger than the others; disposed in indistinct longitudinal and

irregular transverse rows. The longitudinal ranges are sometimes separated by a slight ridge. Peristomes prominent, equally elevated, usually converging, giving to the aperture a pustuliform appearance; apparently not denticulated. Intercellular space vesicular.

This species will be easily distinguished by its irregular growth and pustuliform cell apertures.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Stictopora invertis.

PLATE XXVIII, FIGS. 24-26.

Stictopora invertis, Hall Trans. Albany Institute, vol. x, abstract, p. 15. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 25, figs. 24-26. 1883.

Zoarium consisting of a dichotomously branching, flattened stipe; transverse section broadly lenticular or oval; width of branches from 2 to 3 mm., margins essentially parallel; the non-celluliferous space narrow; greatest thickness 1.25 mm.; bifurcations occur at intervals of from 8 to 10 mm. Cells tubular, length about 1.25 mm., for one-half of their length essentially parallel to the mesotheca, then turning very abruptly outward, continuing at right angles to the axis. Apertures circular, diameter .20 mm.; marginal apertures of the same size as the others; disposed in longitudinal rows, and frequently, on the broader portion of the frond, forming V-shaped rows across the branch, and arching, transverse rows on the narrower portions. Peristomes moderately strong, prominent, equally elevated, not denticulated.

The characteristics of this species are its proportionally great thickness, small, circular cell apertures, and peculiar V-shaped arrangement of the cell rows on the broader portion of the branches.

Formation and locality. Upper Helderberg group, N. Y.

STICTOPORA SEMISTRIATA.

PLATE XXVIII, FIGS. 17–20.

Stictopora semistriata, HALL. Trans. Albany Institute, vol. x, abstract, p. 14. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 28, figs. 17–20. 1883.

ZOARIUM consisting of dichotomously branching, flattened stipes; transverse section lenticular; width of branches about 3 mm., margins divergent; greatest thickness .50 mm.; bifurcations moderately frequent. Cell apertures nearly or quite circular, diameter .30 mm.; marginal apertures slightly larger than the others; more or less distinctly disposed in longitudinal rows, which increase by interstitial addition, the rows being sometimes separated by narrow ridges, at other times the space between them is smooth and the apertures appear irregularly disposed. Peristomes thin, sometimes equally elevated, but usually the anterior portion is slightly and the posterior portion more strongly elevated, frequently with slight denticulations.

This species closely resembles *S. Gilberti*, but the fronds are somewhat narrower, much thinner, the margins of the branches are more nearly parallel, the cell apertures are circular, more irregularly disposed, and the branches are frequently without longitudinal ridges. It may perhaps be only a variety of that species.

Formation and locality. Upper Helderberg group, west of Le Roy, N. Y.

STICTOPORA RHOMBOIDEA.

PLATE XXIX, FIGS. 27, 28.

Stictopora rhomboidea, HALL. Trans. Albany Institute, vol. x, abstract, p. 15. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 29, figs. 27, 28. 1886.

ZOARIUM consisting of a flattened, dichotomously bifurcating frond; width of branches 2 mm., margins essentially parallel; transverse section elliptical; greatest thickness 1 mm. Cell apertures oval, length .33 mm., width two-thirds the length; disposed in longitudinal rows, usually alternating. Ranges of apertures separated by very sinuous ridges, which are frequently anastomosing, giving to the aperture the appearance of being surrounded by a rhom-

boidal peristome. There are also frequent short, interrupted striations between the cell apertures.

The characteristics of this species are so well defined that it will be readily distinguished from any other.

Formation and locality. Upper Helderberg group, west of Le Roy, N. Y.

STICTOPORA PERARCTA.

PLATE XXIX, FIGS. 37, 38.

Stictopora perarcta. HALL. Trans. Albany Institute, vol. x, abstract, p. 15. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 29, figs. 37, 38. 1886.

ZOARIUM consisting of a flattened, bifurcating stipe; width of branches slightly less than 1 mm., margins parallel; transverse section lenticular; greatest thickness about .40 mm. Cell apertures oval, length .20 mm., width from one-half to three-fourths the length; disposed in longitudinal parallel rows, which are separated by prominent ridges; five ranges on each face of the branch. Peristomes thin, very slightly elevated.

This species may be distinguished from *S. linearis* by its larger, oval cell apertures.

Formation and locality. Upper Helderberg group, Onondaga valley, Onondaga county, N. Y.

STICTOPORA LINEARIS.

PLATE XXVIII, FIGS. 4, 5; AND PLATE XXVII, FIG. 1.

Stictopora linearis, HALL. Trans. Albany Institute, vol. x, abstract, p. 15. 1881.
" " Report of State Geologist for 1882. Expl. pl. 25, figs. 4. 5. 1883.
" *rectilatera* (in error). Report of State Geologist for 1885, advance sheets. Expl. pl. 27, fig. 1. 1886.

ZOARIUM consisting of a flattened, dichotomously branching stipe; transverse section lenticular; width of branches 1.50 mm., margins parallel; greatest thickness .50 mm. Cell apertures circular, diameter .20 mm.; disposed in longitudinal parallel rows, five or six rows on each face of a branch. Peristomes thin, slightly and equally elevated. Rows separated by a narrow ridge.

This species may be distinguished by its narrow branches, with infrequent bifurcations and circular cell apertures.

Formation and locality. Upper Helderberg group, N. Y.

INTRAPORA, HALL. 1881.

INTRAPORA PUTEOLATA.

PLATE XXIX, FIGS. 18-26.

Intrapora puteolata, HALL. Trans. Albany Institute, vol. x, abstract, p. 16. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 29, figs. 18–26. 1886.
Compare *Stictoporella interstincta*, ULRICH. Journal Cin. Soc. Nat. Hist., vol. v, No. 3, p. 169. Pl. 8, figs. 9, 9a. 1885.

ZOARIUM consisting of a flattened, dichotomously bifurcating or branching frond, arising from a spreading base; width of branches usually from 2 to 4 mm., but sometimes 20 mm. or more; greatest thickness 1 mm. Cells tubular, for one-half their length essentially parallel with the mesotheca, then turning abruptly outward. Cell apertures oval, length a little more than .25 mm., width three-fourths the length; very closely and irregularly disposed, frequently in contact. Peristomes strong, slightly and equally elevated. Interapertural space occupied by minute angular pits, generally a single series between adjacent apertures. On the non-celluliferous margin of the branch these pits are so disposed that their margins have the appearance of oblique striations. Intercellular space irregularly vesiculose.

The surface of the broader forms of this species is very similar to that of *Fistulipora intercellata*.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

PRISMOPORA, HALL. 1881.

PRISMOPORA TRIQUETRA.

PLATE XXVIII, FIGS. 8-10; AND PLATE XXIX, FIGS. 9-15.

Prismopora triquetra, HALL. Trans. Albany Institute, vol. x, abstract, p. 17. 1881. 1883.
" " " Report of State Geologist for 1882. Expl. pl. 25, figs. 8–10.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 29, figs. 9–15. 1886.

ZOARIUM consisting of an irregular group of triangular branches, usually dichotomously bifurcating, sometimes trifurcating. Faces of the branch equal, width from 3 to 6 mm., concave, the concavity sub-angular along the middle, a comparatively wide space at the margin destitute of cell apertures; greatest

thickness about .80 mm.; bifurcations very frequent. Cells tubular, arising from a mesotheca which extends from the center of the branch to each angle. For one-half the length the cell tubes are nearly parallel with the mesotheca, then turn abruptly outward. Apertures trilobate, frequently papillate, length .24 mm., width slightly less; radiating upward from the center of each face to the margin; usually disposed in more or less regular longitudinal rows, the longitudinal disposition being the more strongly marked near the middle of the branch, sometimes irregularly disposed. Rows sometimes separated by comparatively prominent ridges Peristomes sometimes equally elevated, but usually the posterior margin is the more strongly elevated, having two denticulations. Intercellular space vesiculose, vesicles small and of irregular size.

This species may be distinguished from *P. paucirama* by the much more frequent bifurcations.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Prismopora paucirama.

PLATE XXVIII, FIG. 11; AND PLATE XXIX, FIGS. 16, 17.

Prismopora paucirama, Hall. Trans. Albany Institute, vol. x, abstract, p. 17. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 25, fig. 11. 1883.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 29, figs. 16, 17. 1886.

Zoarium ramose; branches triangular, prismatic; two of the faces equal, width 2.75 mm., width of the third 4 mm., concave; greatest thickness 1.20 mm.; bifurcations occur at intervals of 20 mm. or more. Cell apertures oval or trilobate, sometimes nearly circular, length from .20 to .25 mm., arranged in lines parallel with the axis, smallest at the middle of the branch, gradually growing larger and diverging, until at the margin they are at right angles to the axis; disposed in longitudinal and oblique ascending rows, which diverge from the middle of the branch: peristomes strong, the posterior portion elevated slightly more than the anterior.

Formation and locality. Upper Helderberg group, Thomson's lake, Albany county, N. Y.

PHRACTOPORA, HALL. 1881.

PHRACTOPORA CRISTATA.

PLATE XXXI, FIGS. 36, 37.

Phractopora cristata, HALL. Trans. Albany Institute, vol. x, abstract, p. 12. 1881.
" " Report of State Geologist for 1885. Expl. pl. 31, figs. 36, 37. 1887.

ZOARIUM consisting of explanate fronds, celluliferous on one or both faces, free or incrusting other objects. The surface is raised at irregular intervals into elevated crests, which are celluliferous on each face, sometimes attaining a height of 5 mm. or more. Cells tubular, arising from a mesotheca, oblique to the surface; septa wanting. Apertures sub-circular, oblique, diameter .30 mm.; closely disposed, usually in diagonally intersecting rows. Peristomes thin, posterior portion strongly elevated, projecting over and constricting the opening. The maculæ consist of circular spaces, 1 mm. in diameter, destitute of cell apertures, and occurring at intervals of about 4 mm. The apertures adjacent to these do not radiate from them. Intercellular structure, near the base, irregularly vesiculose, becoming regularly septate above. On a portion of one frond the cell apertures are smaller, crescentic, and denticulated, presenting a very different appearance from the ordinary condition.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

PHRACTOPORA CRISTATA, VAR. LINEATA.

PLATE XXXI, FIGS. 34, 35.

Phractopora cristata, var. *lineata*. Report of State Geologist for 1885. Expl. pl. 31, figs. 34, 35. 1887.

IN this form the crests are not prominent; frequently the surface is traversed by narrow, slightly elevated carinæ. The cell apertures are more nearly circular, less oblique, and the margins more equally elevated than in *P. cristata* proper.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

SCALARIPORA, Hall. 1881.

Scalaripora scalariformis.

PLATE XXIX, FIGS. 4-8.

Scalaripora scalariformis, Hall. Trans. Albany Institute, vol. x, abstract, p. 18. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 29, figs. 4-8. 1886.

Zoarium composed of an irregular group of triangular prismatic branches; faces of the branch equal, width from 3.50 to 4 mm., very concave, the concavity along the middle sub-angular; traversed transversely, at intervals of about 1.50 mm., by very thin, celluliferous scalæ, having a height at the middle of the branch of about 1 mm., thickness .20 mm. Cells tubular, arising from the radiating mesotheca and from the mesotheca of the scalæ, the latter being very oblique, and nearly parallel with the surface. Cell apertures circular, sometimes papillose, diameter about .24 mm.; irregularly disposed, frequently in contact: peristomes strong, sometimes equally elevated, at other times the posterior margin is the most elevated. Intercellular space irregularly vesiculose.

This species differs from *S. subconcava* in its larger branches, the deeper concavity of the sides, and the comparatively more frequent bifurcations.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Scalaripora subconcava.

PLATE XXIX, FIGS. 1-3.

Scalaripora subconcava, Hall. Trans. Albany Institute, vol. x, abstract, p. 18. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 29, figs. 1-3. 1886.

Zoarium composed of triangular branches; sides equal or sub-equal, width from 1 50 to 2 mm., slightly concave; scalæ occurring at intervals of about 1.30 mm., height .50 mm., thickness .25 mm. Cell apertures nearly circular, diameter about .18 mm; irregularly disposed. Peristomes thin, equally or unequally elevated. Intercellular space vesiculose.

This species may be distinguished from *S. scalariformis* by its much smaller size, slight concavity of the face of the branches, and less frequent bifurcations.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

THAMNOTRYPA, N. G.

Thamnopora, Hall. 1881.
Not *Thamnopora*, Steininger. 1831.

THAMNOTRYPA DIVARICATA.

PLATE XXXIII, FIGS. 9, 10.

Thamnopora divaricata, HALL. Trans. Albany Institute, vol. x, abstract, p. 16. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 26, figs. 9, 10. 1883.

ZOARIUM consisting of a main branch or stipe, from which proceed, at irregular intervals, lateral branches diverging at an angle of nearly ninety degrees; width of stipe from 1 to 1.25 mm.; transverse section lenticular; greatest thickness .50 mm.; width of branches .50 mm. Cell apertures oval, length .25 mm., width two-thirds the length; on the stipe usually disposed in two longitudinal rows, sometimes three, and rarely four for a short distance; on the lateral branches there are only two rows Ranges of cells separated by a slight elevation. Peristomes strong, distinctly and equally elevated.

Formation and locality. Upper Helderberg group, near Buffalo, N. Y.

GLAUCONOME, GOLDFUSS. 1826.

GLAUCONOME SINUOSA.

PLATE XXXIII, FIGS. 11, 12.

Glauconome sinuosa, HALL. Trans. Albany Institute, vol. x, abstract, p. 18. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 26, figs. 11, 12. 1883.

WIDTH of main stem slightly less than 1 mm., of lateral branches .50 mm.; transverse section broadly sub-cuneiform. Celluliferous face angular, opposite face rounded. Space between lateral branches equal to the width of a

branch. Cell apertures minute, circular, diameter .15 mm. Ranges of apertures separated by a prominent sinuous carina.

This species may be distinguished from the others by the prominent sinuous carina

Formation and locality. Upper Helderberg group, near Buffalo, N. Y.

Glauconome tenuistriata.

PLATE XXXIII, FIGS. 15-19.

Glauconome tenuistriata, Hall. Trans. Albany Institute, vol. x, abstract, p. 19. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 26, figs. 15-19. 1883.

Width of main stipe .60 mm., of lateral branches .33 mm.; transverse section broadly oval; space between lateral branches about twice the width of a branch. Non-celluliferous face of frond gently rounded and finely striated; celluliferous face angular. Cell apertures circular, diameter .20 mm., three in the space of 1.15 mm. Peristomes distinctly and equally elevated. Surface between ranges of apertures carinated, carina slight.

This species may be distinguished from *G. sinuosa* and *G. nodata* by the greater space between the lateral branches.

Formation and locality. Upper Helderberg group, near Buffalo, N. Y.

Glauconome nodata.

PLATE XXXIII, FIGS. 13, 14.

Glauconome nodata, Hall. Trans. Albany Institute, Vol. v, abstract, p. 18. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 26, figs. 13, 14.

Width of stipe .60 mm., of lateral branches .30 mm.; transverse section broadly oval. Space between lateral branches equal to the width of a branch. Non-celluliferous face gently rounded, finely striated. Cell apertures circular, opening laterally; separated more than the diameter of an aperture; fifteen in the space of five mm. Surface between ranges of apertures elevated with prominent nodes.

This species may be distinguished from *G. sinuosa* by its more slender form and the absence of a carinæ, and from *G. tenuistriata* by the much closer arrangement of the lateral branches.

Formation and locality. Upper Helderberg group, near Le Roy, Genessee county, N. Y.

CRISINELLA, HALL. 1883.

CRISINELLA SCROBICULATA.

PLATE XXXIII, FIGS. 6–8.

Crisina? scrobiculata, HALL. Trans. Albany Institute, vol. x, abstract, p. 20. 1881.
Crisinella " " Report of State Geologist for 1882. Expl. pl. 26, figs. 6–8. 1883.

ZOARIUM ramose, solid, celluliferous on one face, diameter 1 mm.; transverse section circular. Cell apertures circular, diameter 25 mm.; disposed in oblique ascending rows from the center to the margins of the branch; the two series of rows alternating at the center. Space between the rows equal to twice the diameter of an aperture. Peristomes strong, distinctly and equally elevated. Interapertural space occupied by large polygonal pits. Non-celluliferous face of frond finely and irregularly striated.

Formation and locality. Upper Helderberg group, Western New York.

CYSTOPORA, HALL. 1881.

CYSTOPORA GENICULATA.

PLATE LXVI, FIGS. 7, 8.

Cystopora geniculata, HALL. Trans. Albany Institute, vol. x, abstract, p. 20. 1881.

ZOARIUM consisting of a cylindrical aggregation of tubular cells; length of cells 2 mm.; width when first exposed .33 mm., increasing to .50 mm., then contracting, having a diameter at the apertures of .28 mm. Cells alternating, imbricating and forming spiral rows.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

THAMNISCUS, King. 1849.

Thamniscus multiramus.

PLATE XXXIII, FIGS. 1-5.

Thamniscus multiramus, Hall. Trans. Albany Institute, vol. x, abstract, p. 19. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 26, figs. 1-5. 1883.

Zoarium fruticose, several stems arising from a common base, with frequent bifurcations and numerous lateral branches; width of main branches about 1.50 mm., of lateral branches less than 1 mm.; transverse section circular. Frond celluliferous on one face. Cells tubular, length from 1 to 1.50 mm.; for the greater portion of their length procumbent, near the aperture abruptly turning and opening directly outward. Apertures circular, diameter .40 mm. Non-celluliferous face finely striated.

Formation and locality. Upper Helderberg group, Schoharie, Schoharie county, N Y.

FENESTELLA, (Miller) Lonsdale. 1839.

A. Species with two rows of cell apertures on the branch.

a. Forms having either a simple row of nodes, or slightly elevated carinæ with numerous nodes.

Fenestella variapora.

PLATE XLV, FIGS. 1-13; and PLATE XXXV, FIG. 17.

Fenestella variapora, Hall. Trans. Albany Institute, vol. x, abstract, page 28. 1881.
" " " Report of State Geologist for 1885. advance sheets. Expl. pl. 45, figs. 1-13. 1886.
" *patellifera*, Ulrich. Cont. Am. Pal., p. 8, pl. 1, fig. 1. May, 1886.

Bryozoum infundibuliform, of compact appearance. Branches very slender, width just above a bifurcation, .18 to .20 mm., increasing to .25 mm., usually straight, but sometimes zigzag, rounded or slightly angular, smooth in the specimens observed. Interstices usually of about the same width as the branches. Dissepiments comparatively strong, width from .20 to .25 mm., rounded, on a plane with the branches or elevated above them, sometimes connecting with those of adjacent branches, forming continuous, irregular elevations, which are more prominent than the branches themselves; ten in the space of 5 mm. Fenestrules oval or subquadrangular, sometimes circular, length generally from .25 to .30 mm., width from .18 to .30 mm.

On the celluliferous face the dissepiments are rounded and depressed. Fenestrules much narrower than on the opposite face. Cell apertures in two ranges, opening directly outward; thirty in the space of 5 mm.; very closely disposed, frequently in contact: margins distinctly elevated, indenting the borders of the fenestrules; often immediately below a bifurcation, and sometimes on other portions of the branch, there are large cell apertures having twice the diameter of the ordinary apertures. Branches between the ranges of apertures angular, with a line of nodes along the middle.

This species, on the non-celluliferous face, presents so variable an appearance that different fragments might be considered as belonging to different species. Where the frond is macerated the elevated margins of the cell apertures are obsolete, and the apertures apparently open laterally. The nodes are also obsolete. The non-celluliferous face cannot be distinguished from that of *F.* (*U.*) *acaulis*. It very closely resembles *F. serrata*, but the frond is more compact, the fenestrules much smaller, the branches of the celluliferous face less angular. The branches and dissepiments are smaller and more closely arranged than those of *F. stellata*.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella tenella.

PLATE XLV, FIGS. 18, 19.

Fenestella tenella, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 45, figs. 18, 19. 1886.

Bryozoum infundibuliform, compact. Branches very slender, width just above a bifurcation .18 mm., increasing to .35 mm., rigid, angular, with small irregularly disposed nodes. Interstices of the same width as the branches. Dissepiments extremely slender, width about .18 mm., rounded, slightly depressed, eight or nine in the space of 5 mm. Fenestrules oval, length from .35 to .40 mm., width from one-third to one-half the length.

On the celluliferous face the dissepiments are rounded and depressed. Fenestrules as on the opposite face. Cell apertures in two ranges, opening outward; twenty-eight in the space of 5 mm., separated by less than the

diameter of an aperture. Surface carinated; carinæ slightly elevated, strong, nodose; nodes small, regularly disposed.

This species may be distinguished from *F. depressa* by the smaller size of the branches; from *F. tenuis* by its larger branches, and from *F. serrata* and allied forms by its more delicate appearance.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella pertenuis.

PLATE XLV, FIGS. 22, 23.

Fenestella pertenuis, Hall. Trans. Albany Institute, vol. x, abstract, p. 29. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 45, figs. 22, 23. 1886.

Bryozoum infundibuliform. Branches very slender, rigid, rounded, smooth, width just above a bifurcation .15 mm., increasing to .25 mm. Interstices as wide or wider than the branches. Dissepiments comparatively strong, width .15 to .18 mm., rounded, on a plane with the branches, twelve in the space of 5 mm. Fenestrules oval or sub-quadrangular, length from .25 to .30 mm., width from .20 to .30 mm.

On the celluliferous face the dissepiments are rounded, depressed. Fenestrules narrower than on opposite face. Cell apertures in two ranges, opening outward; thirty in the space of 5 mm.; separated by less than the diameter of an aperture: margins indenting the borders of the fenestrules. Branches carinated; carinæ broad, slightly elevated, nodose; nodes comparatively large, regularly disposed, equal in number to the cell apertures.

This species may be distinguished from *F. tenella* by the nearly equal size of the branches and dissepiments; the dissepiments being on a plane with the branches. From nearly all other species it may be distinguished by the small size and close arrangement of the branches and dissepiments.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella parallela.

PLATE XLIV, FIGS. 8–18.

Fenestella parallela, Hall. Trans. Albany Institute, vol. x, abstract, p. 26. 1881.
" " " Report of State Geologist for 1885. Expl. pl. 44, figs. 8–18. 1886.

Bryozoum infundibuliform; fronds large, of compact appearance. Branches very slender, width above a bifurcation .25 mm., increasing to .35 or .45 mm., angular, very gradually enlarging, essentially parallel. Bifurcations distant. Interstices of about the same width as the branches. Dissepiments slender, width .20 mm., angular, slightly depressed, eight in the space of 6 mm. Fenestrules oval, length .50 or .55 mm., width from .25 to .30 mm.

On the celluliferous face the branches are angular. Dissepiments angular, carinated, depressed. Fenestrules of the same appearance as on the opposite face. Cell apertures in two ranges, sixteen in the space of 5 mm., separated by the diameter of an aperture. Surface between ranges of apertures carinated; carinæ slightly elevated, strong, frequently nodose, four nodes in the space of 1 mm.

This species may be distinguished from *F. granilinea* by the two ranges of apertures and the smaller branches; from *F. variopora*, *F. tenella*, *F. pertenuis* *F. latijunctura* and *F. orbirama*, by the coarser appearance of the frond, the larger branches and less frequent dissepiments.

Formation and locality. Upper Helderberg group, near Buffalo, N. Y.

Fenestella curvijunctura.

PLATE XLVI, FIGS. 1–5.

Fenestella curvijunctura, Hall. Trans. Albany Institute, vol. x, abstract, p. 29. 1881.

Bryozoum infundibuliform. Branches very slender, rounded, width above a bifurcation, 16 mm., increasing to .25 or .30 mm. Interstices wider than the branches. Dissepiments slender, width from .16 to .18 mm., rounded, curved, on a plane with the branches, eleven in the space of 5 mm. Fenestrules sub-quadrangular or oval, length from .25 to .30 mm., width usually slightly less than the length, but often equal to it.

On the celluliferous face the dissepiments are rounded, depressed. Fenestrules narrower than on the opposite face. Cell apertures large, in two ranges, opening directly outward, twenty-four in the space of 5 mm., closely disposed, nearly or quite in contact: margins strong, elevated, indenting the border of the fenestrule. Surface carinated; carinæ broad, slightly elevated, nodose; nodes strong, about equal in number to the cell apertures.

This species may be distinguished by its delicate appearance and curved dissepiments.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella confertipora, n. sp.

PLATE XLVI, FIGS. 7-11 AND 17-21.

Bryozoum infundibuliform. Branches of two kinds, usually slender, having a width above a bifurcation of .20 mm., increasing to .35 or .40 mm., but others frequently occur having sometimes twice the diameter of the ordinary branches; the slender branches sometimes proceed laterally from the stronger ones. The larger branches occur most frequently on the basal portion of the frond, becoming less frequent above. Interstices of the same width as the branches or slightly narrower. Dissepiments slender, width from .20 to .25 mm., wider near the base of the frond than above, rounded, smooth, very slightly expanding, on a plane with the branches, nine in the space of 5 mm. Fenestrules oval or sub-quadrangular, length from .30 to .35 mm., width from .20 to .25 mm.

On the celluliferous face the dissepiments are sub-angular and depressed. Fenestrules narrower than on the opposite face, length more than twice the width. Cell apertures large, in two ranges, opening directly outward, twenty-four in the space of 5 mm., in contact; margins elevated, strongly indenting the borders of the fenestrules. Surface between the ranges of apertures carinated; carinæ broad, slightly elevated, nodose; nodes small.

This species may be distinguished by the frequent large branches, sometimes

approaching in character the *sub-genus* PTILOPORELLA and also by the large cell apertures in contact, opening directly outward.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

FENESTELLA STELLATA.

PLATE XLV, FIGS. 14, 15; AND PLATE XLVII, FIGS. 20-36.

Fenestella stellata, HALL. Trans. Albany Institute, vol. x, abstract, p. 29. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 45, figs. 14, 15. 1886.
" *sculptilis*, ULRICH. Journal of the Cincinnati Acad. Sciences. Cont. Am. Pal., p. 10, pl. 1, fig. 3. 1886.

BRYOZOUM infundibuliform. Branches moderately slender, width above a bifurcation .25 mm., increasing to .50 mm., rounded or sub-angular, sometimes smooth, at other times with frequent, prominent, irregularly disposed nodes. Interstices usually narrower than the branches. Dissepiments comparatively strong, width .25 mm., sometimes oblique, rounded or angular, on a plane with the branches, six in the space of 5 mm. Fenestrules oval, length from .50 to .55 mm., width from .25 to .30 mm.

On the celluliferous face the branches are sometimes angular and carinated, but usually both the branches and dissepiments are traversed by narrow grooves or channels, with sharp margins, which are sinuous on the branches. Fenestrules narrower than on the opposite face. Cell apertures in two ranges, opening somewhat laterally, twenty-four in the space of 5 mm., separated by less than half the diameter of an aperture: margins elevated, indenting the borders of the fenestrules. Along the middle of the branches there is a row of very prominent nodes, which are sometimes conical, at other times they are expanded at the summit and present a stellate appearance. Carinated and channeled branches occur on the same frond.

The peculiar channeling of the branches and dissepiments, and the prominent, frequently stellate nodes serve to distinguish this species from any other.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella serrata.

PLATE XLVII, FIGS. 11-19.

Fenestella serrata, Hall. Trans. Albany Institute, vol. x, abstract, p. 28. 1881.

Bryozoum infundibuliform, frond compact. Branches slender, width above a bifurcation from .20 to .25 mm., increasing to .40 or .42 mm., very gradually enlarging, rounded or sub-angular, sometimes smooth but usually nodose, the nodes on some of the fronds being very prominent, sometimes granulose; bifurcations distant. Interstices usually of about the same width as the branches, but sometimes one and one-half times and occasionally twice the width. Dissepiments slender, width from .20 to .25 mm., rounded, slightly depressed, eight or nine in the space of 5 mm. Fenestrules oval, length usually from .35 to .40 mm., width .25 mm.

On the celluliferous face the branches are angular. Dissepiments acutely angular, carinated, depressed below the plane of the branches. Fenestrules of the same appearance as on the opposite face. Cell apertures in two ranges, opening laterally, twenty-two in the space of 5 mm., separated by slightly less than the diameter of an aperture: margins thin, slightly elevated. Surface carinated; carinæ strong, elevated, with sharp, triangular, prominent nodes, about equal in number to the cell apertures.

The non-celluliferous face resembles very nearly some varieties of *F. stellata*. The celluliferous face may be distinguished by the sharply angular branches and dissepiments, which give to this face of the frond the appearance of being divided into small squares, a feature distinguishing it from any other species.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella verrucosa, n. sp.

PLATE XLII, FIG. 11; PLATE XLVI, FIGS. 22, 24.

Bryozoum infundibuliform, fronds large, compact. Branches slender, width above a bifurcation .20 to .25 mm., increasing to .40 and .45 mm., with numerous small nodes, closely and irregularly disposed. Usually, when the

dissepiments are opposite each other, the branch midway between them is elevated; bifurcations distant. Dissepiments, as compared with the branches, strong, width from .30 to .35 mm., rounded, occasionally with one or more nodes, on the same plane or elevated slightly above the branches, six in the space of 5 mm. Fenestrules oval, length .45 or .50 mm., width .25 mm.

On the celluliferous face the dissepiments are rounded, much depressed. Fenestrules narrower than on the opposite face. Cell apertures in two ranges, twenty-two in the space of 5 mm., separated by less than the diameter of an aperture: margins thin, slightly elevated. Surface between rows of apertures carinated; carinæ strong, slightly elevated, with small, closely disposed nodes on the summit.

The non-celluliferous face resembles *F. stellata* but the branches of the celluliferous face are never channeled and do not have prominent nodes.

This species may be distinguished from *F. serrata* by its generally coarser appearance, the greater distance of the dissepiments, there being respectively six and nine dissepiments in the same space.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella depressa.

PLATE XLV, FIGS. 16, 17.

Fenestella depressa, Hall. Trans. Albany Institute, vol. x, abstract, p. 30. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 45, figs. 16, 17. 1886.

Bryozoum infundibuliform. Branches slender, width above a bifurcation .30 mm., increasing to .45 mm., rounded, finely striated. Interstices narrower than the branches. Dissepiments very slender, width .18 mm., rounded, much depressed, nine in the space of 5 mm. Fenestrules oval or sub-quadrangular, length .40 mm., width about .20 mm.

On the celluliferous face the dissepiments are rounded, much depressed. Fenestrules having the same appearance as on the opposite face. Cell apertures in two ranges, opening directly outward, twenty-six in the space of 5 mm., separated by less than the diameter of an aperture: margins elevated,

strongly indenting the borders of the fenestrules. Surface between ranges of apertures angular, nodose.

This species may be distinguished by the depressed dissepiments on both faces of the frond.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella æqualis.

PLATE XLVI, FIGS. 27–31.

Fenestella æqualis, Hall. Trans. Albany Institute, vol. x, abstract, p. 31. 1881.

Bryozoum infundibuliform. Branches moderately slender, width above a bifurcation .30 mm., increasing to .50 mm., very gradually enlarging, rigid, angular, slightly carinated. Nearly all the specimens observed are partially covered by the original rock deposit, leaving only the summits of the branches exposed, giving them a very slender appearance; width not more than .20 mm.; bifurcations distant. Interstices nearly twice as wide as the branches. Dissepiments comparatively strong, width .30 mm., angular, slightly carinated, on a plane with the branches, five in the space of 5 mm. Fenestrules sub-quadrangular, length 70 mm., width about .50 mm.

On the celluliferous face the branches are angular. Dissepiments angular, much depressed. Fenestrules smaller and more oval than on the opposite face. Cell apertures in two ranges, eighteen in the space of 5 mm., separated less than the diameter of an aperture: margins thin, slightly elevated. Surface slightly carinated and with prominent conical nodes which usually occur opposite a dissepiment, but frequently on other portions of the frond.

This species may be distinguished by the rigid branches, sub-quadrangular fenestrules, strong dissepiments, and the prominent nodes opposite dissepiments on the celluliferous face.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

b. Forms having a smooth carina.

FENESTELLA BISERIATA, n. sp.

PLATE XLII, FIGS. 16–18.

BRYOZOUM infundibuliform. Branches moderately slender, width above a bifurcation .35 mm., increasing to .50 mm.; very gradually enlarging, straight, somewhat rigid in appearance, rounded or sub-angular, finely striated, occasionally with minute nodes; bifurcations distant. Interstices wider than the branches, sometimes twice the width. Dissepiments very slender, width .22 mm., rounded or sub-angular, sometimes slightly carinated, nearly on a plane with the branches, five in the space of 5.50 mm. Fenestrules sub-quadrangular or oval, length nearly .80 mm., width usually about .50 mm.

On the celluliferous face the branches are angular. Dissepiments rounded or sub-angular, very much depressed. Fenestrules a little narrower than on the opposite face. Cell apertures in two ranges, opening somewhat laterally, twenty in the space of 5 mm., separated by the diameter of an aperture: margins thin, slightly elevated. Surface between ranges of apertures angular, sub-carinated.

Formation and locality. Upper Helderberg group, Cherry Valley, Otsego county, N. Y.

FENESTELLA PECULIARIS.

PLATE XLII, FIGS. 19–21.

Fenestella peculiaris, HALL. Report of State Geologist for 1882. Expl. pl. 33, figs. 19–21. 1883.

BRYOZOUM infundibuliform. Branches slender, very gradually enlarging; width above a bifurcation .33 mm., increasing to .40 or .45 mm.; obtusely angular, except for a short distance before bifurcating, carinated, carina and other parts of the branch nodose or granulose. When the frond is much macerated the nodes are obsolete and the carina is much more prominent than in well-preserved specimens. Interstices a little wider than the branches. Dissepiments slender, width .30 mm., flattened, granulose, slightly depressed, five in the space of 5 mm. Fenestrules oval, length .70 mm., width .35 to .40 mm.

On the celluliferous face the branches are angular. Dissepiments rounded, depressed. Cell apertures in two ranges, fifteen in the space of 5 mm, separated by the diameter of an aperture. Branch carinated, carina slightly elevated, but conspicuous.

This species may be readily distinguished by its obtusely angular, carinated branches.

Formation and locality. Upper Helderberg group, near Caledonia, N. Y.

Fenestella dispanda.

PLATE XLIV, FIGS. 1-4.

Fenestella dispandus, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 44, figs. 1-4. 1886.

Bryozoum infundibuliform, of lax growth. Branches slender, rounded, width above a bifurcation .25 mm., increasing to .50 mm. Interstices two or three times the width of the branches. Dissepiments very slender, width .20 mm., frequently oblique to the branches, angular, slightly depressed, seven in the space of 5 mm. Fenestrules sub-quadrangular, length about 1.25 mm., width .50 mm.

On the celluliferous face the branches are angular. Dissepiments angular, depressed Fenestrules of the same appearance as on the opposite face. Cell apertures in two ranges, eighteen in the space of 5 mm., separated by slightly more than the diameter of an aperture; carinæ slight.

This species may be distinguished by the slender branches and the straggling appearance of the frond.

Formation and locality. Upper Helderberg group. Western New York, particular locality not recorded.

Fenestella singularitas.

PLATE XLVI, FIGS. 12-16.

Fenestella singularitas, Hall. Trans. Albany Institute, vol. x, abstract, p. 29. 1881.

Bryozoum infundibuliform. Branches moderately slender, width above a bifurcation .25 mm., increasing to .45 mm., rounded, finely striated; generally

there is a prominent conical node below each bifurcation. Interstices narrower than the branches. Dissepiments slender, width .20 to .25 mm, usually rectangular to the branch, but sometimes oblique, rounded, on a plane with the branches, eight or nine in the space of 5 mm. Fenestrules oval, length from .35 to .40 mm., width from .20 to .25 mm.

On the celluliferous face the dissepiments are angular, depressed, comparatively strong. Fenestrules narrower than on the opposite face. Cell apertures in two ranges, opening laterally, twenty in the space of 5 mm., separated by less than the diameter of an aperture: margins slightly elevated. Surface between the ranges of apertures angular, elevated. Below each bifurcation, and sometimes on other portions of the branch, there is a strong node similar to those on the opposite face.

This species may be distinguished by its prominent nodes which usually occur immediately below a bifurcation on both faces of the frond.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella proceritas, n. sp.

PLATE XLVI, FIGS. 32, 35, 36.

Bryozoum infundibuliform, fronds large. Branches slender, width above a bifurcation .25 mm., increasing to .50 mm., very gradually enlarging, the increase in size often scarcely perceptible, straight, rounded, with very fine granulose striations and small nodes; bifurcations distant. Interstices much wider than the branches. Dissepiments very slender, width .20 mm., rounded, finely striated, very slightly expanded, nearly on a plane with the branches, four in the space of 5 mm. Fenestrules sub-quadrangular, length from a little more than 1 mm. to 1.60 mm., width .45 or .50 mm.

On the celluliferous face the branches are angular. Dissepiments angular and much depressed. Fenestrules somewhat narrower than on the opposite face. Cell apertures in two ranges, opening laterally, fifteen in the space of 5 mm., separated by a little more than the diameter of an aperture: margins very thin, slightly elevated. Surface between ranges of apertures sharply angular, elevated about .18 mm.

This species may be easily distinguished by its slender branches, of essentially the same size for nearly their entire length, and the large, sub-quadrangular fenestrules.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella sinuosa.

PLATE XLIV, FIGS. 5, 6.

Fenestella sinuosa, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 44, figs. 5, 6. 1886.

Bryozoum infundibuliform. Branches strong, width above a bifurcation .75 mm., increasing to 1.25 mm., sinuous, angular, slightly carinated. Interstices from slightly narrower to wider than the branches. Dissepiments strong, width .60 mm., angular, carinated, depressed, ten in the space of 5 mm. Fenestrules oval, length about 1.35 mm., width usually from .60 to .75 mm.

On the celluliferous face the dissepiments are rounded, carinated, much depressed. Fenestrules of about the same appearance as on the opposite face. Cell apertures in two ranges, fourteen in the space of 5 mm., separated by one-half the diameter of an aperture. Branches carinated, carinæ thin, prominent, height, .25 mm.

The non-celluliferous face of this species so closely resembles that of *F* (*Polypora*) *robusta*, that it is difficult to distinguish the two; but the celluliferous face has, of course, only a remote resemblance to that species.

Formation ond locality. Upper Helderberg group, near Caledonia, N. Y.

Fenestella tuberculata, n. sp.

PLATE XLVI, FIGS. 25, 26, 33, 34.

Bryozoum infundibuliform, fronds large. Branches moderately slender, very gradually enlarging, width above a bifurcation .30 mm., increasing to .60 mm., straight, abruptly rounded or sub-angular, with frequent, prominent, conical nodes, irregularly disposed and forming the most characteristic feature of the frond. Interstices wider than the branches. Dissepiments very slender, width .20 mm., rounded, slightly expanded, depressed below the plane of the

branches; about six in the space of 5 mm. Fenestrules oval or sub-quadrangular, length 1.40 mm., width from .50 to .60 mm. The celluliferous face has not been observed.

This species may be distinguished by the comparatively slender branches, with frequent, prominent, conical nodes, and the large fenestrules. It most nearly resembles *F. proceritas*, but the branches are stronger and the fenestrules larger.

Formation and locality. Upper Helderberg group, Ontario, Canada.

Fenestella clathrata, n. sp.

(not figured.)

Bryozoum infundibuliform. Branches moderately slender, width above a bifurcation .35 mm., increasing to .50 or .60 mm., sometimes more, angular and slightly carinated, very gradually enlarging, increase in width scarcely perceptible, sinuous or zig-zag, anastomosing or connected by very short dissepiments; bifurcations infrequent. Interstices of about the same width as the branches. Dissepiments strong, width .66 mm., angular, slightly carinated, the carinæ connecting with those of the branches and on the same plane; when the branches anastomose the portions so connected have the same width as the dissepiments; the carinæ of adjacent branches unite and at their junction have a small conical node, four in the space of 5 mm. Fenestrules broadly oval, frequently nearly circular, length .55 mm.

On the celluliferous face the branches are sinuous. Dissepiments rounded, slightly depressed. Fenestrules a little narrower than on the opposite face. Cell apertures in two ranges, opening directly outward, twenty in the space of 5 mm., separated by less than the diameter of an aperture: margins very distinctly elevated, but not indenting the border of the fenestrules. Surface between ranges of apertures carinated; carinæ moderately thick, slightly elevated.

This species is similar in general appearance to *F. erectipora*, but may be distinguished by its smaller, more closely arranged branches and more closely

disposed dissepiments, there being eleven branches in the same space occupied by seven in that species; there are twenty cell apertures in the same space occupied by fourteen in that species; from *F. interrupta* by the more regular appearance of the non-celluliferous face and by the absence of prominent, expanding carinæ; from *F.* (*Reteporina*) *coalescens* by the more closely arranged branches and dissepiments and, as compared with the branches, much wider dissepiments; from *F.* (*Reteporina*) *rhombifera* by the much closer disposition of the branches and dissepiments, and the narrower dissepiments. It is very similar on its non-celluliferous face to *F. labiata* of the Hamilton group, and from that face alone it is very difficult to make a satisfactory distinction; the celluliferous face is very different.

Formation and locality. Upper Helderberg group, Ontario, Canada.

Fenestella erectipora.

PLATE L, FIGS. 15, 17.

Fenestella erectipora, Hall. Trans. Albany Institute, vol. x, abstract, p. 32. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 50, figs. 15, 17. 1886.

Bryozoum infundibuliform, sometimes narrowly, at other times rapidly expanding. Branches moderately slender, width above bifurcation .34 to .40 mm., increasing to .50 mm., very gradually enlarging, sinuous or zig-zag, usually connected by short dissepiments, but sometimes anastomosing, angular, with small conical nodes opposite the dissepiments or on the anastomosed portions, sometimes slightly carinated; bifurcations comparatively distant. Interstices wider than the branches. Dissepiments strong, width .60 mm., rounded or angular, on a plane with the branches, three in the space of 4 mm. Fenestrules oval, length about .70 mm., width .45 to .60 mm.

On the celluliferous face the branches are slightly and regularly sinuous. Dissepiments rounded, much depressed. Fenestrules smaller than on the opposite face, the length sometimes appearing less than the width of the dissepiment. Cell apertures in two ranges, opening directly outward, fourteen in the space of 5 mm., separated by one and one-half times the diameter of an aperture: margins distinctly elevated. Surface between the ranges of apertures carinated, carinæ sinuous, narrow, height about .25 mm.

This species most nearly resembles *F.* (*Reteporina*) *rhombifera* and *F. granifera*; from the first it may be distinguished as follows: the branches are not so decidedly anastomosing, the dissepiments are narrower and more closely disposed, there being eight in the same space occupied by five in that species; from *F. granifera*, by the branches being generally more angular, with small conical nodes, and without the line of granules along the middle of the branch, characteristic of that species; the carina does not expand, is slightly elevated and has no nodes on the sides.

Formation and locality. Upper Helderberg group, near Buffalo, N. Y.

Fenestella cultrata.

PLATE L, FIGS. 1-5.

Fenestella cultrata, Hall. Trans. Albany Institute, vol. x, abstract, p. 29. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 50, figs. 1-5. 1886.

Bryozoum infundibuliform. Branches moderately slender, width above a bifurcation .35 mm., increasing to .75 mm., rounded or sub-angular, becoming flattened for a short distance before bifurcation. Interstices generally wider than the branches. Dissepiments slender, width from .25 to .35 mm., rounded, on a plane with the branches and frequently oblique to them; usually about two in the space of 5 mm. Fenestrules sub-quadrangular, length from 1.75 to 2.25 mm., width from .40 to .80 mm.

On the celluliferous face the dissepiments are rounded, much depressed. Fenestrules of the same appearance as on the opposite face. Cell apertures in two ranges, opening laterally, eighteen in the space of 5 mm., closely disposed, frequently in contact. Surface between ranges of apertures carinated; carinæ strong, angular, height .30 mm.

This species most nearly resembles *F. biserrulata*, but is more lax in appearance, the fenestrules are larger, the cell apertures open laterally, and the carina does not expand and has no nodes on the side.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Reteporina) rhombifera.

PLATE L, FIGS. 18, 19.

Fenestella rhombifera, Hall. Trans. Albany Institute, vol. x, abstract, p. 32. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 50, figs. 18, 19. 1886.
Compare *Fenestella striata*. Thirty-sixth Annual Rept. N. Y. State Mus. Nat. Hist., extract, p. 72. 1884.

Bryozoum infundibuliform, rapidly expanding, sometimes having a diameter of 80 mm. at 30 mm. from the base. Branches moderately slender, width above a bifurcation .35 mm., increasing to .45 or .50 mm., very gradually enlarging, zig-zag, anastomosing, angular, slightly carinated, with a conical node at the junction, the frond presenting a regular reticulated appearance. Interstices much wider than the branches. The anastomosed portions have a width of .70 or .80 mm.; three in the space of 5.50 mm.

On the celluliferous face the branches are straight or a little sinuous, connected by short dissepiments, which are rounded and much depressed. Fenestrules narrower than on the opposite face, width a little less than .50 mm. Cell apertures in two ranges, opening laterally, fourteen in the space of 5 mm., separated by more than the diameter of an aperture: margins thin, slightly elevated. Surface between ranges of apertures carinated; carinæ strong, height .40 mm.

The non-celluliferous face of this species so nearly resembles that of *F. striata* of the Hamilton group, that no satisfactory distinction can be made. On the celluliferous face the branches are more nearly straight, and rigid in appearance, the carina is much stronger and higher, the fenestrules are larger, the cell apertures open laterally, are farther apart, there being only fourteen in the same space occupied by twenty or twenty-two in that species.

Formation and locality. Upper Helderberg group, Ontario, Canada.

Fenestella (Reteporina) coalescens.

NOT FIGURED.

Bryozoum infundibuliform. Branches moderately slender, very gradually enlarging, width above a bifurcation .30 mm., increasing to .45 mm., angular,

zig-zag, anastomosing, and having a prominent conical node at the points of junction. Interstices more than twice the width of the branches. Width of anastomosed portion a little less than .50 mm., three in the space of 5.50 mm. Fenestrules regularly oval, length about 1.30 mm., width .75 mm.

On the celluliferous face the branches are sharply rounded, connected by short dissepiments which are rounded and very much depressed. Fenestrules much narrower than on the opposite face, the interstices being only a little wider than the branches. Cell apertures in two ranges, opening a little laterally, seventeen in the space of 5 mm., separated by about the diameter of an aperture. Surface between ranges of apertures carinated; carina thick, height about .50 mm.

This species closely resembles *F.* (*Reteporina*) *rhombifera*, but the dissepiments are a little narrower and the carina is smooth; the carina of that species has a row of small nodes on each margin of the summit; the non-celluliferous face so closely resembles some forms of that of *F. striata* of the Hamilton group, that it is very difficult to satisfactorily distinguish them; on the celluliferous face the carina is much thicker and higher.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

c. Forms having prominent carinæ with expanded summits.

Fenestella lunulata.

PLATE XLVII, FIGS. 1-10.

Fenestella lunulata, Hall. Trans. Albany Institute, vol. x, abstract, p. 31. 1881.
Semicoscinium obliquatum, Ulrich Cont. Am. Pal., vol. 1, No. 1, p. 13, pl. 1. 1886.

Bryozoum infundibuliform, frequently of irregular growth, sometimes twisted or involved. Branches very slender, width above a bifurcation .25 mm., increasing to .45 mm., rounded or sub-angular, often irregular. Interstices of about the same width as the branches. Dissepiments strong, width from .25 to .40 mm., oblique, having on the summit a prominent lunate elevation, which extends upon the branches, the extremities connecting with the elevations of adjacent dissepiments, obscuring the branches, and sometimes giving to the frond the appearance of being composed of oblique walled cells. On

the margin of the elevation there is a prominent conical node which frequently projects over the fenestrules. On some fronds the dissepiments and branches are also granulose. Fenestrules oval, frequently appearing triangular from the projecting node of the dissepiments, length from .40 to .50 mm., width usually from one-half to three-fourths the length, but sometimes equal to it.

On the celluliferous face the dissepiments are rounded, much depressed. Fenestrules much smaller than on the opposite face; the width of the dissepiment being greater than the length of the fenestrule. Cell apertures in two ranges, opening directly outward, twenty in the space of 5 mm., separated by half the diameter of an aperture; margins elevated, strongly indenting the borders of the fenestrules. Surface between the ranges of apertures carinated; height of carina .30 mm.; very thin below, expanding to a width of .30 mm. at the summit.

This species may be easily distinguished by the lunate elevations, with conical nodes, on the non-celluliferous face; even when worn or macerated it preserves evidence of these characteristics.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella bi-imbricata.

PLATE XLVIII, FIGS. 6–11.

Fenestella bi-imbricata, Hall. Trans. Albany Institue, vol. x, abstract, p. 31. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 48, figs. 6–11. 1886.

Bryozoum infundibuliform, fronds large. Branches moderately slender, width above bifurcation .38 mm., increasing to .50 mm., sub-parallel, the enlargement scarcely perceptible, angular, slightly carinated, decidedly zig-zag and very irregular, anastomosing or connected by short dissepiments; thickness 1 mm., transverse section sub-cuneiform. Dissepiments stronger than the branches, oblique, the summit frequently forming a semi-circular elevation which extends upon the branches, the extremities connecting with those of adjacent dissepiments, giving to the frond the appearance of a festooned-

reticulate structure (fig. 8). At other times the reticulate structure has become obsolete and the surface presents the aspect of an explanate frond, penetrated by large oblique cells as in fig. 7. At other times the dissepiments, or anastomosed portions, are elevated above the branches continuing across them, coalescing with those of adjacent branches and forming very irregular transverse, continuous elevations, which form the most prominent feature; this condition of the frond so obscures the branches that it is nearly impossible to trace them, the frond presenting a stelliform reticulate appearance. Fenestrules variable in size and form, oval, circular or sub-triangular.

The celluliferous face is very regular, the branches slightly sinuous, very closely disposed, nearly parallel. Dissepiments strong, width from .90 to 1.15 mm., oblique, rounded, depressed, three in the space of 5 mm. Fenestrules regularly oval, small, length .40 to .45 mm., width .25 mm. Cell apertures in two ranges, opening directly outward, twenty-two in the space of 5 mm., very closely disposed, nearly or quite in contact: margins thin, distinctly elevated. Surface between ranges of apertures carinated, height of carina .50 mm., thin below, then expanding, the summit flat and having a width of nearly .50 mm.; generally one side of the carina is more expanded than the other, the summits imbricating, as shown in figs. 10, 11. Some of the fronds have no resemblance to the branches and dissepiments of a Fenestella, but resemble some forms of Lichenalia

This species most nearly resembles *F. interrupta*, but may be distinguished by its oblique, much wider dissepiments, and the coarser appearance of the frond.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella interrupta.

PLATE XLVIII, FIGS. 12-17.

Fenestella interrupta, Hall. Trans. Albany Institute, vol. x, abstract, p. 32. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 48, figs. 12-17. 1886.

Bryozoum infundibuliform, fronds large, compact. The non-celluliferous face of the frond is so irregular, that it is usually almost impossible to trace the

branches except for a short distance. Branches slender, width .30 mm., increasing to .50 mm., angular, slightly carinated, decidedly zig-zag, anastomosing or connected by very short dissepiments. Transverse section of a branch sub-cuneiform, thickness .75 mm. The dissepiments or anastomosed portions are wider than the branches, and elevated above their plane, continuing across them, coalescing with those of adjacent branches, forming irregular continuous ridges, which are the most prominent feature of the frond, obscuring the branches and giving to the non-celluliferous face a stelliform-reticulate appearance. Fenestrules variable in form and size, oval, circular, or sometimes rhomboidal.

The celluliferous face of the frond presents a rigid appearance, the branches are slightly sinuous, very gradually enlarging, sub-parallel. Dissepiments very short, width .60 mm., rounded, depressed, five in the space of 5 mm. Fenestrules regularly oval, small, length .40 mm., width about .25 mm. Cell apertures in two ranges, opening somewhat laterally, twenty-four in the space of 5 mm., separated by less than the diameter of an aperture. Surface between ranges of apertures carinated; carina .40 mm. in height, thin below, then expanding, the summit flat, and having a width of .30 mm.

The two faces of the frond are so unlike each other that seen separately they would easily be mistaken for different species. The non-celluliferous face of this species may be distinguished from that of *F. semirotunda* by its coarser appearance; the celluliferous faces have little resemblance. Both faces of the frond very nearly resemble *F. bi-imbricata*, but the structure is not so coarse in appearance, the dissepiments and branches are smaller: there are four dissepiments in the same space occupied by two in that species; the dissepiments of *F. bi-imbricata* having frequently a width of more than 1 mm. From other species of similar manner of growth it may be distinguished by its size.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella granifera.

PLATE L, FIGS. 12-14, 16.

Fenestella (Hemitrypa) granifera, Hall. Trans. Albany Institute, vol. x, abstract, p. 33. 1881.
" *granifera*, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 50, figs. 12–14, 16. 1886.

Bryozoum infundibuliform, fronds very large, with frequent broad folds or undulations on a line with the branches. Branches moderately slender, width above a bifurcation .30 mm., increasing to .45 mm., very gradually enlarging, sub-parallel, frequently sinuous, flattened, sub-angular or angular, with a row of fine granules along the middle; bifurcations distant. Interstices wider than the branches. Dissepiments strong, width usually .55 mm., flattened, on a plane with the branches, four in the space of 5 mm. Fenestrules broadly oval, length .70 mm., width from .40 to .50 mm.

On the celluliferous face the dissepiments are rounded, depressed. Fenestrules more elongate-oval than on the opposite face. Cell apertures in two ranges, twenty in the space of 5 mm., opening directly outward, separated by less than the diameter of an aperture. Surface between ranges of apertures carinated; carinæ strong with the summits expanded, and having on each margin a row of minute nodes.

Formation and locality. Upper Helderberg group, near Leroy village, Genesee county, N. Y.

d. Forms having the carinæ expanded midway of their height and contracting above, with the margins nodose.

Fenestella semirotunda.

PLATE XLIX, FIGS. 11-22.

Fenestella semirotunda, Hall. Trans. Albany Institute, vol. x, abstract, p. 32. 1881.

Bryozoum broadly infundibuliform, compact. Branches slender, width above a bifurcation .20 to .25 mm., increasing to .40 and .45 mm.; transverse section sub-cuneiform, thickness about 1 mm.; anastomosed or connected by short dissepiments, sinuous or zig-zag, rounded or angular, slightly carinated, fre-

quently with numerous, irregularly disposed, small conical nodes. The branches are sometimes regular, at other times very irregular. Interstices wider than the branches. Dissepiments strong, width usually about .50 mm., on a plane with the branches or elevated above, sometimes continuing across the branch, coalescing with those of adjacent branches and forming continuous, very irregular transverse ridges, which are more prominent than the branches, often giving to the frond a reticulated appearance, five dissepiments in the space of 5 mm. Fenestrules oval, length .50 mm., width from .30 to 40 mm.

On the celluliferous face the frond is more regular. Dissepiments rounded, very much depressed. Fenestrules smaller than on the opposite face. Cell apertures in two ranges, opening directly outward, twenty in the space of 5 mm., closely disposed, nearly or quite in contact: margins thin, distinctly elevated, indenting the borders of the fenestrules. Surface between ranges of apertures carinated; carina about .50 mm. in height, at first thin, expanding for about one-half the height, then contracting, the summit being thin; on each margin of the expanded portion there is a row of small triangular nodes, about equal in number to the cell apertures. There are also, at irregular distances, but always over a dissepiment, semicircular projections, extending half way to the adjacent carina; these when occurring opposite to each other frequently coalesce

The non-celluliferous face of this species resembles that of *F. interrupta*, but the branches are smaller; the celluliferous face may be readily distinguished from any other species of this formation by the semicircular projections on the dissepiments; from *F. labiata* of the Hamilton group, it may be distinguished by its smaller and more closely disposed branches and dissepiments, the presence of nodes on the carinæ, and the more irregular appearance of the non-celluliferous face.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

FENESTELLA PERMARGINATA.

PLATE XLIX, FIGS. 1-10.

Fenestella permarginata, HALL. Trans. Albany Institute, vol. x, abstract p. 30. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 49, figs. 1-10. 1886.

BRYOZOUM infundibuliform. Branches moderately slender, width above a bifurcation .30 mm., increasing to .50 mm., rounded or flattened. Interstices slightly wider than the branches. Dissepiments strong, width .60 to .65 mm., gently rounded or flattened, on a plane with the branches, about four in the space of 5 mm. Fenestrules oval, length .60 mm., width .25 or .30 mm.; in well preserved specimens there is usually an elevation .20 mm. wide and of about the same height, extending around each fenestrule, giving to the branches and dissepiments the appearance of being concave.

The celluliferous face of the frond is more regular. Dissepiments rounded, much depressed. Fenestrules smaller than on the opposite face. Cell apertures in two ranges, opening directly outward, twenty in the space of 5 mm., separated by less than one-half the diameter of an aperture: margins strongly elevated, indenting the border of the fenestrule. Surface between ranges of apertures carinated; carina about .60 mm. high, slightly expanding for about one-half its height, then contracting, the summit sharp; on each margin of the expanded portion there is a row of triangular concave nodes, equal in number to the cell apertures.

This species may readily be distinguished from any other of this formation, by the prominent elevation surrounding the fenestrules; from *F. exornata* of the Hamilton group, it may be distinguished by the much smaller and more closely disposed branches and dissepiments, and the rows of nodes on the margins of the expanded portion of the carina.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella biserrulata.

PLATE L, FIGS. 6-11.

Fenestella biserrulata, Hall. Trans. Albany Institute, vol. x, abstract, p. 30. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 50, figs. 6-11. 1886.

Bryozoum infundibuliform. Branches moderately slender, width above a bifurcation .33 mm., increasing to .70 mm., rounded or sub-angular, with a row of granules along the middle of the branch. Interstices slightly wider than the branches. Dissepiments slender, width .30 mm., rounded, on a plane with the branches, about three in the space of 4.50 mm.; each dissepiment is marked by an elevation which extends upon and along the branch nearly to the next dissepiment, frequently giving angularity to the narrower portions of the branch. Fenestrules oval, length about 1.25 mm., width from .35 to .50 mm.

On the celluliferous face the dissepiments are rounded, much depressed. Fenestrules slightly narrower than on the opposite face. Cell apertures in two ranges, opening directly outward, eighteen in the space of 5 mm., separated by less than the diameter of an aperture. Surface between ranges of apertures carinated, carina about .40 mm. in height, expanding for one-half the height, then contracting; on each margin of the expanded portion there is a line of minute nodes, about equal in number to the cell apertures.

This species may be distinguished from similar forms by the large fenestrules.
Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella latijunctura.

PLATE XLVIII, FIGS. 1-5.

Fenestella latijunctura, Hall. Trans. Albany Institute, vol. x, abstract, p. 31. 1881.
" " " Report of State Geologist for 1885, advance sheets. Expl. pl. 48, figs. 1-5. 1886.

Bryozoum infundibuliform, fronds large. Branches moderately slender, width above a bifurcation .25 to .30 mm., increasing to .50 mm., irregular, usually angular, slightly carinated, sometimes rounded, with more or less prominent,

conical nodes. Interstices of about the same width as the branches. Dissepiments strong, width from .60 mm. to slightly more than 1 mm., on a plane with the branches, sometimes angular, with a slight carina, which connects with that of the branches; at other times flat, and having on the upper portion a semicircular elevation, which extends upon the branches; on some fronds these are elevated above and continue across the branches, coalescing with those of adjacent branches, forming very irregular transverse ridges. The dissepiments are so prominent that the branches frequently appear merely as short processes connecting the strong transverse elevations, from three to five in the space of 5 mm. Fenestrules oval, length usually about .50 mm., width .30 to .35 mm.

The celluliferous face of the frond is very regular. Dissepiments rounded, very much depressed. Fenestrules smaller and more regularly oval than on the opposite face. Cell apertures in two ranges, opening directly outward, eighteen in the space of 5 mm.; closely disposed, separated by less than one-half the diameter of an aperture: margins thin, distinctly elevated, indenting the borders of the fenestrules. Surface between ranges of apertures carinated; carina having an elevation of about .70 mm., extremely thin, slightly expanded at a little less than one-half the height, then contracting, the summit being sharp: margins of the expanded portion of the carina marked by a row of concave, triangular nodes, equal in number to the cell apertures.

This species will be easily recognized by the interrupted appearance of the branches on the non-celluliferous face, and the high, thin carinæ, with rows of nodes; in the latter respect resembling *F. biserrulata*, but it is distinguished from that species by the irregular appearance of the frond, and the much smaller fenestrules.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella perplexa.

NOT FIGURED.

Fenestella (Hemitrypa) perplexa, Hall. Trans. Albany Institute, vol. x, abstract, p. 33. 1881.
" *bigeneris*, Ulrich. Cont. Am. Pal., vol. i, No. 1, p. 11, pl. 2, figs. 1, 1a.

Bryozoum infundibuliform. Branches slender, width above a bifurcation usually from .20 to .25 mm., increasing to .35 or .40 mm., usually straight, sometimes irregular, rounded, nodose; nodes small, irregularly disposed; transverse section of branch cuneiform, width .25 to .40 mm., depth 1.25 mm. Interstices of about the same width as the branches. Dissepiments slender, width .25 mm., depth 1 mm., rounded, on a plane with the branches or elevated above, sometimes continuing across the branch and coalescing with adjacent dissepiments, forming very irregular transverse ridges, seven in the space of 5 mm. Fenestrules oval, length .45 mm., width about .25 mm.

On the celluliferous face the dissepiments are angular, carinated, the carinæ extending upon the branch and to the summit of the carina of the branch. Fenestrules narrower than on the opposite face. Cell apertures in two ranges, opening laterally, twenty in the space of 5 mm., separated by less than the diameter of an aperture. Branches carinated; carinæ thin, height .25 mm., and having, on the summit, a row of irregular nodes, which extend beyond the carinæ and have precisely the appearance as if they had been originally extended and connected adjacent carinæ forming scalæ, which had been broken away, leaving only the attached portions; twenty in the space of 5 mm.

This species may be very easily distinguished, by the peculiar appearance of the summit of the carina.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

e. Forms in which the carinæ of adjacent branches, on the celluliferous side, are connected by transverse scalæ.

UNITRYPA, S. G., HALL. 1885.

(See page 54.)

FENESTELLA (UNITRYPA) ACAULIS.

PLATE LI, FIGS. 1-6.

Fenestella (Hemitrypa) acaulis, HALL. Trans. Albany Institute, vol. x, abstract, p. 33. 1881.
" *(Unitrypa)* " " Report of State Geologist for 1885, advance sheets. Expl. pl. 51, figs. 1-6. 1886.
Unitrypa conferta, ULRICH. Cont. Am. Pal., vol. i, No. 1, p. 17, pl. 1, figs. 8, 8a. 1886.

BRYOZOUM infundibuliform, compact. Branches slender, width above a bifurcation .20 to .24 mm., increasing to from .35 to .50 mm., the strength varying on different fronds, straight, angular when well preserved, rounded when worn, sometimes smooth, at other times nodose; nodes irregularly disposed, or in one or more longitudinal lines. Interstices usually narrower than the branches, but on some fronds wider. Dissepiments slender, width from .20 to .25 mm., angular or rounded, on the same plane or elevated above the branches, sometimes continuing across and coalescing with those of adjacent branches, forming irregular, continuous transverse elevations more prominent than the branches, about eight in the space of 5.50 mm. Fenestrules oval, length .40 to .50 mm., width usually from .20 to .25 mm., but on some fronds occasionally .35 mm.

On the celluliferous face the dissepiments are rounded, very much depressed. Fenestrules narrower than on opposite face, length often three times the width. Cell apertures in two ranges, opening directly outward, oblique to the axis of the branch, twenty-four in the space of 5 mm., separated by less than one-half the diameter of an aperture: margins elevated, strongly indenting the borders of the fenestrule, those of adjacent branches sometimes nearly in contact. Surface between ranges of apertures carinated; carinæ .50 mm. in height, very thin below, expanding to a width of about .15 mm.; carinæ connected by scalæ, the summits of which have a width of about .14 mm.; these extend downward till within a short distance of the branch, for half the distance obliquely toward the base, then abruptly bending

in the opposite direction, twenty-four in the space of 5 mm. (See fig. 4.) Interstices oval or lenticular, as wide or wider than the summits of the scalæ. The summit of the carina extends above the scalæ and is very conspicuous, sometimes slightly carinated, occasionally with very prominent, sharp nodes.

This species may be distinguished by the very slender, closely disposed, scalæ, and by the prominence of the summit of the carina. The non-celluliferous face so nearly resembles that of *F. variapora* that it is not possible to make a satisfactory distinction; the celluliferous faces have little resemblance to each other.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Unitrypa) acaulis var. inclinis, n. var.

NOT FIGURED.

The dissepiments are very oblique, their summits sharp, more or less curved and frequently extending upon the branches, which are angular and slightly carinated. The non-celluliferous face is very dissimilar to the ordinary forms of *F.* (*U.*) *acaulis*, but the celluliferous face is similar.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Unitrypa) projecta, n. sp.

NOT FIGURED.

This species is very similar to *F.* (*U.*) *acaulis*, but the branches are somewhat stronger and more rigid; the dissepiments are oblique and have on the upper portion a prominent, paliform node, which projects over the fenestrule.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Unitrypa) transversa, n. sp.

NOT FIGURED.

Branches very slender, width above a bifurcation .20 mm., increasing to .30 mm., sinuous or ziz-zag, angular. Interstices wider than the branches. Dissepiments comparatively strong, width .25 mm., angular, six in the space of

5 mm., on a plane with the branches or elevated above them, very frequently extending across the branch, uniting with adjacent dissepiments and forming prominent, irregular, transverse elevations, which are the most conspicuous feature of the frond and give to it a very irregular appearance. Fenestrules oval, length .50 mm. or more, width from .25 to .30 mm.

On the celluliferous face the scalæ have a width of .25 to .30 mm., twelve in the space of 5 mm.; summit of carina angular, slightly carinated, elevated above the scalæ.

This species most nearly resembles *F.* (*U*) *stipata;* on the non-celluliferous face the branches are more slender and much more irregular; the dissepiments more prominent: on the celluliferous face the scalæ have broader summits, which are not oblique; on the side of the carina the scalæ are directed obliquely toward the base of the frond only, not bent as in *F.* (*U.*) *stipata* and *F.* (*U.*) *tegulata.*

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Unitrypa) nana, n. sp.

NOT FIGURED.

Bryozoum infundibuliform. Fronds small, rapidly expanding. Branches very slender, width above a bifurcation about .16 mm., increasing to .30 mm., straight, rounded or sub-angular; when perfectly preserved slightly carinated, when a little worn or marcerated, smooth; bifurcations frequent. Interstices wider than the branches. Dissepiments extremely slender, width .12 mm., rounded, much expanded at their junction with the branches, slightly depressed, ten in the space of 5 mm. Fenestrules oval, length .38 mm., width .28 mm.

On the celluliferous face the dissepiments are rounded, slightly carinated, very much depressed. Fenestrules narrower than on the opposite face. Cells in two ranges, opening outward, twenty in the space of 5 mm., separated by less than the diameter of an aperture: margins thin, indenting the borders of the fenestrules. Summit of carina .10 mm. in width; scalæ very thin, oblique, twenty-two in the space of 5 mm.

This species may be distinguished from *F.* (*U.*) *acaulis*, by the more slender and closely disposed dissepiments, which are slightly depressed below the plane of the branches; from *F.* (*U.*) *stipata*, by the more slender and more rapidly enlarging branches, the narrower and more frequent dissepiments, there being eleven in the same space occupied by seven in that species, and by the much more numerous scalæ; from *F.* (*U.*) *tegulata* by the much more closely disposed scalæ.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Unitrypa) stipata.

PLATE LI, FIGS. 7-14.

Fenestella (*Hemitrypa*) *stipata*, Hall. Trans. Albany Institute, vol. x, abstract, p. 34. 1881.
" (*Unitrypa*) " " Report of State Geologist for 1885, advance sheets. Expl. pl. 51, figs. 7-14. 1886.

Bryozoum infundibuliform, compact. Branches slender, width above a bifurcation .25 mm., increasing to .50 mm., sometimes straight, but generally sinuous or zig-zag, connected by very short dissepiments, angular, carinated; carina slight, sometimes granulose or nodose; on some fronds the carinæ of adjacent branches unite on the dissepiments, having a small, conical node at the junction. Interstices usually a little narrower than the branches. Dissepiments strong, width generally from .35 to .40 mm., angular, carinated; carinæ similar to those of the branches and connecting with them, six in the space of 5 mm., on the same plane or elevated above the branches, very frequently extending across them, coalescing with adjacent dissepiments, forming irregular, continuous elevations, which are more conspicuous than the branches, and give to the frond an irregular appearance. Fenestrules oval, length generally from .45 to .50 mm., width .33 mm.; on one frond length .25 mm., width .20 to .25 mm.

On the celluliferous face the dissepiments are rounded, much depressed. Fenestrules narrower than on the opposite face, length more than twice the width. Cell apertures in two ranges, opening nearly directly outward, eighteen in the space of 5 mm., closely disposed, nearly or quite in contact: margins elevated, indenting the borders of the fenestrules. Surface between

ranges of apertures carinated; height of carina about .70 mm., very thin below, then expanding to a width of about .25 mm., connected by very thin scalæ, the summits of which are about .18 mm. wide. These processes extend inward nearly to the branch, at first obliquely toward the base, then abruptly bending, continue in the opposite direction, fourteen in the space of 5 mm. Interstices narrow, oval. The summits of the carinæ extend above the scalæ.

This species very closely resembles *F.* (*U.*) *tegulata*, but the non-celluliferous face is more irregular, the dissepiments wider and the fenestrules smaller: on the celluliferous face the scalæ are thicker and less oblique; the summits of the carinæ are wider and more elevated above the scalæ; those of *F.* (*U.*) *tegulata*, being sharp and either very slightly, or not at all, elevated above the connecting scalæ.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Unitrypa) tegulata.

PLATE LI, FIGS. 15-23.

Fenestella (*Hemitrypa*) *tegulata*, Hall. Trans. Albany Institute, vol. x, abstract, p. 34. 1881.
" (*Unitrypa*) " " Report of State Geologist for 1885, advance sheets. Expl. pl. 51, figs. 15–23. 1886.
Unitrypa retrorsa, Ulrich. Cont. Am. Pal., vol. i, No. 1, pl. 1, figs. 7 *a*, *b*, *c*. 1886.

Bryozoum infundibuliform. Branches slender, width above a bifurcation .25 mm., increasing to from .30 to .40 mm., very gradually enlarging, increase in size hardly perceptible, sub-parallel, straight or sinuous, rarely zig-zag, angular, slightly carinated; bifurcations distant. Interstices wider than the branches. Dissepiments slender, width about .25 mm., angular, carinated, on the same plane or elevated above the branches, sometimes continuing across the branch, connecting with adjacent dissepiments and forming irregular, transverse ridges, very rarely prominent enough to obscure the branches, six in the space of 5 mm. Fenestrules oval, length from .50 to .60 mm., width .25 or .30 mm.

On the celluliferous face the dissepiments are rounded, much depressed. Fenestrules narrower than on the opposite face. Cell apertures in two

ranges, opening outward, twenty-two in the space of 5 mm.; closely disposed; margins thin, distinctly elevated. Surface between ranges of apertures carinated; carinæ thin, height .60 mm., summits frequently sinuous; scalæ very thin, fourteen in the space of 5 mm., directed obliquely away from the base for a short distance, then abruptly bending and continuing toward the base, the latter portion having twice the depth of the former. Fenestrules narrow, elongate oval. Summit of carina not elevated above the scalæ.

The celluliferous face of this species closely resembles that of *F.* (*U.*) *fastigata*, but the dissepiments of that species, so far as observed, are never elevated above the branches, and there is frequently a slight elevation around the fenestrules. The scalæ of both species, near the surface, are obliquely directed from the base, but those of this species are more closely disposed, there being fourteen in the same space occupied by six in that one. From *F.* (*U.*) *stipata* it may be distinguished by its somewhat coarser and more regular aspect, its larger fenestrules, its thinner and more oblique scalæ. The summit of the carina is thin and not elevated above the scalæ.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Unitrypa) lata.

PLATE LII, FIGS. 1-10.

Fenestella (*Hemitrypa*) *lata*, Hall. Trans. Albany Institute, vol. x, abstract, p. 34. 1881.
Unitrypa spatiosa, Hall, in error. Report of State Geologist for 1884. Pl. 2, fig. 12. 1885.

Bryozoum infundibuliform, fronds large, with frequent, broad, radial undulations or folds. Branches slender, width above a bifurcation .30 mm., increasing to .50 mm., very gradually enlarging, often the same size for nearly the entire length, rounded or flattened, nodose; nodes small, conical, sometimes forming a row along the middle of the branch, at other times irregularly disposed; bifurcations distant. Interstices as wide as the branches. Dissepiments slender, width .25 to .30 mm., rounded, on a plane with the branches, four in the space of 4 mm., carinated; carinæ thin, slightly elevated, but very distinct. Fenestrules oval, length .70 to .75 mm., width .35 mm.

On the celluliferous face the dissepiments are rounded, carinated, much depressed. Fenestrules narrower than on the opposite face. Cell apertures

in two ranges, opening directly outward, slightly oblique to the axis of the branch, sixteen in the space of 5 mm.: margins elevated, strongly indenting the borders of the fenestrule. Carina nearly 1 mm. in height; the lower half very thin, then slightly expanding, width at the summit .20 mm. Scalæ thin, extending downward nearly to the branch, for a short distance oblique toward the base, then abruptly bending and continuing in the opposite direction, width of the outer portion about .30 mm.; eleven or twelve in the space of 5 mm. Interstices oval, slightly narrower than the scalæ.

This species may be distinguished from any other of this geological formation by the large size of the branches, which are rounded or flattened and sometimes nodose; the carinated dissepiments and the thin scalæ which at the summit are directed obliquely toward the base. From *F.* (*U.*) *scalaris* of the Hamilton group, it may be distinguished as follows: the branches are less frequent, they are without carinæ and regular rows of nodes or granules: there are only six branches in the same space occupied by from eight to ten in that species.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Unitrypa) ficticius, n. sp.

PLATE LII, FIGS. 11-15.

Bryozoum infundibuliform, fronds large. Branches slender, width above a bifurcation .25 mm., increasing to .50 mm., rounded or slightly flattened, sometimes carinated. Interstices of about the same width as the branches. Dissepiments slender, width .30 mm., flattened or gently rounded, frequently with a slight elevation near the upper margin, which extends upon the branches bordering the lower portion of the fenestrule, four in the space of 5 mm. Fenestrules oval, length .80 mm., width .33 mm.

On the celluliferous face the dissepiments are rounded, carinated, very much depressed. Fenestrules narrower than on the opposite face. Cell apertures in two ranges, opening directly outward, oblique to the axis of the branch, sixteen in the space of 5 mm., separated by somewhat less than the

diameter of an aperture; margins slightly elevated, not indenting the borders of the fenestrules. Carina .60 mm. high; for a little less than half the height very thin, expanding and contracting, the summit angular and slightly carinate. Scalæ very thin, oblique from the base, outer margin arched, width, as seen from above, .35 mm., seven or eight in the space of 5 mm. Interstices oval, of nearly the same width as the scalæ.

This species may be distinguished from *F.* (*U.*) *stipata*, *F.* (*U.*) *fastigata* and *F.* (*U.*) *tegulata* by the size of the branches and fenestrules, and from other species of *Unitrypa* of this formation by the direction of the obliquity of the scalæ.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Unitrypa) acclivis, n. sp.

PLATE LII, FIGS. 16-23.

Bryozoum infundibuliform. Branches moderately slender, width above a bifurcation .30 mm., increasing to .55 or .60 mm., rounded or flattened, sometimes with a prominent line of nodes along the middle of the branch, and scattered nodes on each side; at other times with two equally prominent lines of nodes; occasionally, on the wider portions of the branch, there are three rows of nodes, which are small, but very distinct, four or five in the space of 1 mm. Interstices wider than the branches. Dissepiments comparatively strong, width .45 mm., rounded, irregularly nodose, very slightly depressed, four in the space of 5 mm. Fenestrules regularly oval, length .80 mm., width .50 mm.

On the celluliferous face the branches are usually slightly sinuous. Dissepiments short, rounded, very much depressed. Fenestrules narrower than on the opposite face. Cell apertures in two ranges, opening almost directly outward, sixteen in the space of 5 mm., separated by less than the diameter of an aperture. Carina .60 mm. in height, thin. Scalæ thin, strongly curved, the outer margin forming a half circle, with the convexity toward the base, oblique in the same direction, five or six in the space of 5 mm. Summit of carina interrupted, obscured by the scalæ; this surface of the frond has

the appearance of being composed of oblique, imbricating, walled cells. Frequently the frond is broken in such a manner, that the under side of the carinæ and scalæ are shown, when they present precisely the same appearance as the non-celluliferous face of some frond of a species having very slender, angular branches, strong, rounded dissepiments and nearly circular fenestrules.

The character of the scalæ separates this species from all others of this formation, except *F.* (*U.*) *pernodosa* and *F.* (*U*) *elegantissima;* from the former of which it is distinguished by the more regular branches, narrower, more rounded dissepiments and the lines of nodes on the branches; from the latter, by the more slender branches and dissepiments, smaller fenestrules and the ornamentation of the branches.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Unitrypa) pernodosa.

PLATE LIII, FIGS. 1-11.

Fenestella (*Hemitrypa*) *pernodosa*, Hall. Trans. Albany Institute, vol. x, abstract, p. 35. 1881.
" (*Unitrypa*) " " Report of State Geologist for 1885, advance sheets. Expl. pl. 53, figs. 1-11. 1886.

Bryozoum infundibuliform, fronds large. Branches slender, width above a bifurcation about .30 mm., scarcely increasing in size until just before bifurcating, when the width is from .50 to .60 mm., sub-parallel, rounded or sub-angular, ornamented with prominent nodes, irregularly disposed, but usually at varying distances along the middle of the branch. Interstices a little wider than the branches. Dissepiments strong, width .75 mm., flattened or gently rounded, a little depressed, occasionally nodose; when the dissepiments of a branch are opposite to each other the branch has the appearance of a slight ridge crossing the dissepiments. Fenestrules oval, length .90 mm., width about .45 mm.

On the celluliferous face the branches appear stronger, usually sinuous. Dissepiments rounded, much depressed. Fenestrules narrower than on the opposite face. Cell apertures in two ranges, opening nearly directly outward,

sixteen in the space of 5 mm., separated by less than the diameter of an aperture: margins distinctly elevated and indenting the borders of the fenestrules. Carinæ thin, height .60 mm. Scalæ very thin, oblique; outer margin strongly curved, forming a semicircle, the curvature being toward the base of the frond, and oblique in the same direction; six in the space of 5 mm. Summit of the carina very thin, sometimes straight and distinct, at other times interrupted by the scalæ and indistinct; sometimes this surface of the frond is so irregular that it closely resembles some forms of Alveolites.

The obscured or interrupted branches, wide dissepiments and prominent nodes of this species will be sufficient to distinguish it from any other of this geological formation.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Unitrypa) elegantissima.

PLATE LIII, FIGS. 12-17.

Fenestella (*Hemitrypa*) *elegantissima*, Hall. Trans. Albany Institute, vol. x, abstract, p. 36. 1881.
" (*Unitrypa*) " " Report of State Geologist for 1885, advance sheets. Expl. pl. 53, figs. 12-17. 1886.

Bryozoum infundibuliform, fronds large. Branches moderately slender, width above a bifurcation .35 mm., increasing to .65 mm., gently rounded or flattened, sub-angular, carinated; carina slightly elevated and with small but very distinct nodes, four in the space of 1 mm. Interstices wider than the branches. Dissepiments strong, width from .75 mm. to 1 mm., gently rounded or flattened, slightly depressed, four in the space of 9 mm. Fenestrules oval, length 1.25 mm., width .60 mm.

On the celluliferous face the branches are rounded, usually sinuous. Dissepiments rounded, very much depressed. Fenestrules of nearly the same appearance as on the opposite face. Cell apertures in two ranges, opening directly outward, oblique to the axis of the branch, sixteen in the space of 5 mm., separated by less than the diameter of an aperture. Carinæ thin, 1 mm. in height. Scalæ thin, outer margin forming a semicircular or semi-oval curvature which is convex toward the base of the frond, oblique in the

same direction, two in the space of 5 mm. Summits of carinæ very thin, sometimes distinct and straight, at other times interrupted and obscured by the scalæ; under these conditions this face of the frond appears to be composed of oblique, imbricating, walled cells. Fenestrules oval, length 1.25 mm., width .70 mm.

This species may be distinguished from *F.* (*U.*) *pernodosa* by the size of the branches and fenestrules and in the character of the ornamentation of the branches; from *F.* (*U.*) *acclivis* by the larger size and more distant branches and dissepiments, and from all other species at present known by the character of the scalæ.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Unitrypa) fastigata.

PLATE LIV, FIGS. 1-6.

Fenestella (*Hemitrypa*) *fastigata*, Hall. Trans. Albany Institute, vol. x, abstract, p. 36. 1881.

Bryozoum infundibuliform. Branches slender, width above a bifurcation .25 mm., increasing to .35 or .40 mm., very gradually enlarging, for the greater portion of their length of essentially the same size, angular, carinated; carina slight, but distinct. Interstices of the same width as the branches. Dissepiments comparatively strong, width .25 mm., flat or angular, on a plane with the branches, six in the space of 5 mm. Fenestrules oval, length .55 mm., width .30 mm. Very frequently there is a narrow elevation on the dissepiments and branches surrounding the fenestrules.

On the celluliferous face the dissepiments are rounded, much depressed. Fenestrules narrower than on the opposite face. Cell apertures in two ranges, opening outward, twenty in the space of 5 mm., separated by half the diameter of an aperture: margins elevated, strongly indenting the borders of, and partially obscuring the fenestrules. Carina thin, height 1 mm. Scalæ very thin, curved, oblique, the direction being away from the base, lower portion the stronger, not bent, seven in the space of 5 mm. Summits of carinæ very thin, not elevated above the scalæ. Interstices nearly circular.

This species may be distinguished by the elevations around the fenestrules, the distant scalæ which are directed obliquely away from the base, and not curved; and by the circular interstices.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

f. Forms similar to Unitrypa but having the scalæ. distant from each other.

FENESTELLA (UNITRYPA ?) CONSIMILIS, n. sp.

PLATE LIV, FIGS. 7-9.

BRYOZOUM consisting of large infundibuliform fronds, very gradually expanding from the base. The non-celluliferous face has not been observed.

On the celluliferous face the branches are moderately slender, width .35 mm., increasing to .60 mm., very gradually enlarging, essentially parallel, straight, angular. Interstices of the same width as the branches. Dissepiments strong, width .60 mm., rounded, slightly carinated, much depressed, four in the space of 6 mm. Fenestrules oval, length .90 mm., width .35 mm. Cell apertures in two ranges, opening directly outward, very broadly oval, slightly oblique to the axis of the branch, sixteen in the space of 5 mm., separated by half the diameter of an aperture: margins elevated, indenting the borders of the fenestrules. Branches carinated; carina .60 mm. high, at first very thin, but immediately expanding, the summit having precisely the appearance of the branches of a non-celluliferous face; width above a bifurcation .33 mm., increasing to about .60 mm., rounded, slightly carinated. Scalæ or pseudo-dissepiments slender, width about .30 mm., rounded, slightly carinated, on a plane with, or elevated above the carina, five in the space of 5 mm. Fenestrules oval, length .70 mm., width .35 mm.

This species is very easily distinguished from any other at present known in this geological formation.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

g. Forms having the lateral processes or scalæ distant, and the dissepiments of the non-celluliferous face with circular apertures.

ISOTRYPA, Hall. 1885.

Fenestella (Isotrypa) conjunctiva.

PLATE LIV, FIGS. 16–21.

Fenestella (Hemitrypa) conjunctiva, Hall. Trans. Albany Institute, vol. x, abstract, p. 36. 1881.
Isotrypa bifaria, Hall, in error. Report of State Geologist for 1884, extract. Expl. pl. 2, figs. 13, 16. 1885.

Bryozoum infundibuliform, fronds large. Branches moderately slender, width above a bifurcation .38 mm., increasing to .60 or .70 mm., straight, rounded or angular, slightly carinated, sometimes small, at other times nodose; on the narrower parts of the branch the nodes are usually disposed in a row along the middle of the branch; on the wider portions in two or three rows, sometimes irregularly disposed, and at other times the branches, especially the wider portions, are striated. Interstices slightly wider than the branches. Dissepiments comparatively strong, width .40 mm., rounded, carinated, a little depressed, four in the space of 5 mm.; very frequently there is a comparatively large circular opening in the upper portion of the dissepiment, having a diameter about .25 mm., the margins slightly elevated. This aperture very rarely occurs in any other position. Fenestrules oval, length .85 mm., width .40 mm.

On the celluliferous face the branches are often slightly sinuous. Dissepiments rounded, very much depressed. Fenestrules of about the same appearance as on the opposite face. Cell apertures in two ranges, opening at an angle of forty-five degrees, sixteen in the space of 5 mm., separated by less than the diameter of an aperture: margins elevated, thin, slightly indenting the borders of the fenestrules. Carina at first thin, expanding and having a width of .33 mm. at the summit, which is angular and slightly carinated; carinæ connected by scalæ or pseudo-dissepiments of the same width as the summit of the carina, angular, slightly carinated; five in the space of 5 mm. Interstices broadly oval or sub-quadrangular, length .67 mm., width .50 mm.

This face of the frond has precisely the appearance of the non-celluliferous face of a Fenestella, with slender distant branches and dissepiments. The under side of the carina and scalæ have a stronger appearance than the upper face. When the carina is broken away, it gives to the branch the appearance of having a line of small nodes along the middle.

This species will be easily distinguished on the non-celluliferous face by the conspicuous apertures in the dissepiments; on the celluliferous face by the slender, distant scalæ connecting the carinæ, and the angular appearance of that surface of the frond.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

h. Forms having both the branches and dissepiments carinated, carinæ much expanded above; the two faces of the frond similar in appearance.

LOCULIPORA, Rominger MS., nov. gen.

Compare Semicoscinium, Prout. 1859.

Fenestella (Loculipora) circumstata, n. sp.

PLATE LIV, FIGS. 22-25.

Bryozoum consisting of large infundibuliform fronds of irregular appearance. Branches moderately slender, width above a bifurcation about .35 mm., and continuing of essentially the same size until within a short distance of a bifurcation, where the width is about .50 mm., usually decidedly zig-zag, sometimes so irregular that the branch can be traced only a short distance, the frond presenting a somewhat regular, reticulate appearance; sometimes anastomosing, but usually connected by a short dissepiment, acutely angular, slightly carinated; bifurcations infrequent. Interstices wider than the branches. Dissepiments strong, width variable, sometimes not wider than the branches, but usually from .50 to .60 mm., angular, carinated, on a plane with the branches, three or four in the space of 5 mm. Fenestrules broadly oval, length from .75 to 1 mm., width .50 to .60 mm., sometimes nearly equal to the length.

On the celluliferous face the dissepiments are angular, on a plane with the branches. Fenestrules of about the same appearance as on the opposite face. Cell apertures in two ranges, opening directly outward, disposed around the fenestrules, there being two apertures on each dissepiment, seven or eight apertures around each fenestrule: margins distinctly elevated but not indenting the borders of the fenestrule. Branches and dissepiments carinated, connected, carina about .50 mm. in height, at first very thin, but immediately expanding and giving an appearance very similar to the non-celluliferous face of the frond; carinæ of branches about .30 mm. in width, gently enlarging before bifurcation, angular, slightly carinated; dissepiments .45 mm. wide, angular, slightly carinated, on a plane with the branches; interstices broadly oval. This surface, if seen from above, would be very easily mistaken for the non-celluliferous face of some frond.

This species very nearly resembles *F.* (*L.*) *perforata* of the Hamilton group, but the frond is coarser, the fenestrules larger, the dissepiments less frequent; there being only two in the same space occupied by three or four in that species.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

i. Forms having the carinæ connected by scalæ which meet midway between the carinæ of adjacent branches, forming a pseudo-carina.

HEMITRYPA, Phillips. 1841.

Fenestella (Hemitrypa) cribrosa.

NOT FIGURED.

Fenestella (*Hemitrypa*) *cribrosa*, Hall. Trans. Albany Institute, vol. x, abstract, p, 35. 1881.

Bryozoum infundibuliform. Branches slender, width above a bifurcation .30 mm., increasing to .50 mm., more or less rapidly expanding, arising from a thin, broadly spreading, striated base, incrusting other objects. The pedicel is of uniform appearance and characteristic, usually having a length of about 5 mm., and a nearly constant diameter of a little more than 2 mm.; the branches extend its entire length, and when well preserved they are generally rounded, but sometimes angular, frequently concave below a bifurcation, with numerous small, elongate, narrow nodes, which are sometimes

irregularly disposed, at other times in one or more longitudinal lines; there are also fine, slightly elevated striations; when worn or macerated the branches are flattened and smooth; bifurcations frequent. Interstices narrower than the branches. Dissepiments very slender, width about .18 mm., rounded or sub-angular, very slightly depressed; nine in the space of 5 mm. Fenestrules oval, length .40 mm., width from .15 to .20 mm.

On the celluliferous face the dissepiments are very much depressed, rounded. Fenestrules very narrow. Cell apertures in two ranges, opening outward, twenty in the space of 5 mm., separated by the diameter of an aperture: margins elevated, indenting the borders of the fenestrules. Carina having a height of about .30 mm., thin, expanded and flat at the summit, width about .12 mm., frequently sinuous or zig-zag. Scalæ and pseudo-carina flat and of the same width as the carinæ; twenty scalæ in the space of 5 mm. Interstices circular, diameter about .25 mm. Around each fenestrule is a slight elevation, which gives to the summit of the carinæ and scalæ the appearance of being concave. From each one of the scalæ there is a slight elevation on the sides of the carina extending inward to the branch; in peculiar conditions of weathering the intermediate thinner portions of the carina are destroyed, leaving the summit with the appearance of being supported by rows of minute columns.

This species may be distinguished by the characteristic pedicel, and by the elevation around the interstices of the hemitrypic face; also when ornamented, by the peculiar appearance of the nodes of the non-celluliferous face.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Hemitrypa) columellata.

NOT FIGURED.

Bryozoum infundibuliform, frond compact. Branches slender, width above a bifurcation .25 mm., increasing to .40 mm., very gradually enlarging, straight or sinuous, angular or sub-angular, slightly carinated, usually with a small node opposite each dissepiment; bifurcations comparatively distant. Interstices narrower than the branches. Dissepiments, compared with the

branches, strong; width .33 to .38 mm., angular, slightly carinated, seven in the space of 5 mm., on a plane with the branches or elevated above them; sometimes continuing across the branches and uniting with adjacent dissepiments, forming irregular, continuous elevations, which are very prominent, but do not obscure the branches. Fenestrules oval, length from .33 to .38 mm., width .25 mm.

On the celluliferous face the branches are straight: dissepiments rounded or sub-angular, slightly carinated, depressed. Fenestrules much narrower than on the opposite face, the length being frequently as much as three times the width. Cell apertures in two ranges, opening directly outward, twenty-five in the space of 5 mm., separated by less than half the diameter of an aperture: margins remarkably elevated, attaining a height of .10 mm., indenting the borders of the fenestrules; carina .40 mm. high; summit sometimes sharp, at other times .10 mm. wide. Scalæ and pseudo-carinæ, usually slightly narrower than the carinæ, twelve scalæ in the space of 5 mm. Interstices nearly circular or sub-quadrangular; frequently the summits of the carinæ are sharp and irregular, this face of the frond then having the appearance of some form of PALESCHARA. (In fact, some authors have mistaken similar forms for incrusting corals.) The carina is apparently formed from the connecting of a row of small columns by a thin plate; when this is removed there is no evidence that the thinner portion proceeded from the branch, the base having very much the appearance of a row of nodes or cell apertures. This face of the frond with the carinæ removed, might be very easily mistaken for some form having three rows of cell apertures.

The non-celluliferous face of this species so closely resembles *F.* (*Unitrypa*) *stipata*, that it is not possible to satisfactorily distinguish them. The celluliferous faces are, of course, very different. From *F.* (*Hemitrypa*) *favosa* or *F.* (*H.*) *nana*, it is distinguished by its stronger branches and very much stronger dissepiments; from *F.* (*H.*) *cribrosa* by its much stronger dissepiments; from *F.* (*H.*) *biordo*, by its more slender branches, more closely disposed branches and dissepiments and much smaller fenestrules.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Hemitrypa) favosa.

NOT FIGURED.

Fenestella (Hemitrypa) favosa, Hall. Trans. Albany Institute, vol. x, abstract, p. 35. 1881.

Bryozoum infundibuliform, compact. Branches very slender, bifurcating at varying distances; width above a bifurcation .25 mm., increasing to .50 mm.; rapidly enlarging when the bifurcations are frequent; often increasing in size, then contracting and again enlarging before bifurcation; angular and slightly carinated when well preserved. Interstices of the same width, or slightly narrower than the branches. Dissepiments extremely slender, width from .15 to .18 mm., angular, slightly carinated, depressed, rounded when worn or macerated, from eight to ten in the space of 5 mm. Fenestrules oval, length from .35 to .40 mm., width usually about .25 mm.

On the celluliferous face the frond has a more compact appearance. Dissepiments angular, slightly carinated, much depressed. Fenestrules smaller than on the opposite face. Cell apertures in two ranges, opening laterally, twenty in the space of 5 mm., separated by a little less than the diameter of an aperture; margins equally elevated, slightly indenting the borders of the fenestrules. Carina thin, height .25 mm., summit not expanded. Scalæ and pseudo-carina of the same strength as the summits of the carinæ proper; eighteen scalæ in the space of 5 mm. The carinæ and pseudo-carinæ are frequently zig-zag, the interstices then having the appearance of hexagonal cell apertures; when the carina is broken away the base has the appearance of a row of prominent triangular nodes, along the middle of the branch.

The non-celluliferous face of this species resembles that of *F.* (*Unitrypa*) *nana*, but the branches are more closely disposed, the fenestrules narrower, and when the bifurcations are frequent the branches increase in size more rapidly; the frond also presents a more compact appearance; on the celluliferous face the difference is at once observed. From *F.* (*H.*) *columellata* it differs by the less uniform size of the branches and the more slender dissepiments, those of that species being as wide or wider than the branches; on the celluliferous face the summit of the carinæ and the scalæ are more slender. The non-celluliferous face so closely re-

sembles that of *F.* (*H.*) *cribrosa* that it is very difficult to distinguish them, but the branches are angular, slightly carinated, never nodose as in that species. On the celluliferous face the difference is more apparent; the summits of the carinæ and the scalæ in this species are sharp, while in that species they are expanded and flat, the interstices are smaller and surrounded by a slight elevation, but the two forms are very nearly related.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Hemitrypa) biordo, n. sp.

NOT FIGURED.

Bryozoum infundibuliform, fronds large, compact. Branches slender, width above a bifurcation .25 mm., increasing to .50 mm., very gradually enlarging, increase in size scarcely perceptible, sub-parallel, rounded and smooth on the specimens observed; bifurcations distant. Interstices wider than the branches. Dissepiments comparatively strong, width .35 mm., rounded, sometimes slightly carinated, on a plane with the branches or elevated above, sometimes continuing across the branch, coalescing with adjacent dissepiments and forming very irregular, transverse ridges, which though prominent, do not obscure the branches, nine in the space of 10 mm. Fenestrules regularly oval, length .55 mm., width from .35 to .40 mm.

On the celluliferous face the branches are straight and rigid. Dissepiments rounded, very much depressed. Fenestrules narrower than on the opposite face, the length being more than twice the width. Cell apertures in two ranges, opening laterally at an angle of about forty-five degrees, sixteen in the space of 5 mm., separated by less than the diameter of an aperture: margins slightly elevated, not indenting the borders of the fenestrules. Carinæ very thin, width of summit about .12 mm. Scalæ and pseudo-carinæ of the same width; eighteen scalæ in the space of 5 mm. Interstices sub-quadrangular, nearly square or sub-circular. When the scalæ alternate the carinæ and pseudo-carinæ are zig-zag, this surface of the frond then having the appearance of being composed of hexagonal cells, resembling the surface of a Favosites.

This species may be distinguished from *F.* (*H.*) *columellata*, by the more distant branches and dissepiments, and consequent larger fenestrules, there being only nine dissepiments in the same space occupied by fourteen in that species; from *F.* (*H.*) *favosa*, by the much wider dissepiments and their greater distance, the dissepiments of that species being very slender; from *F.* (*H.*) *nana*, by the same characters that distinguish it from *F.* (*H.*) *columellata*; from *F.* (*H.*) *cribrosa*, by the wider and more distant dissepiments; from all the species at present known it is generally distinguishable by the much coarser appearance of the frond.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

POLYPORA, McCoy. 1845.

B. Species having more than two ranges of cell apertures on the branch.

a. Forms having two and three ranges of cell apertures.

Fenestella (Polypora) celsipora.

PLATE XLI, FIGS. 16–22; AND PLATE XLII, FIG. 5–10.

Fenestella celsipora, Hall. Trans. Albany Institute, vol. x, abstract, p. 24. 1881.
" (*Polypora*) *celsipora?* Hall. Report of State Geologist for 1882. Expl. pl. 33, figs. 5–8. 1883.
" " " ? " Report of State Geologist for 1882. Expl. pl. 33, figs. 9, 10. 1883.
" " " " Report of the State Geologist for 1885, advance sheets. Expl. pl. 41, figs. 16–22. 1886.

Bryozoum infundibuliform, fronds large, with frequent, strong, radial undulations. Branches moderately slender, very gradually increasing in size, rounded or sub-angular, occasionally granulose; width above a bifurcation .25 to .30 mm., increasing to .50 or .60 mm., bifurcations at intervals of from 15 to 40 mm. Interstices usually wider than the branches, sometimes twice the width. Dissepiments comparatively strong, width varying from .33 to .50 mm., rounded, granulose, five in the space of 5 mm., on the same plane with the branches and expanded at their junction. Fenestrules variable in size, broadly oval or sub-quadrangular, width from two-thirds to three-fourths the length, sometimes the two dimensions are nearly or quite equal.

On the celluliferous face the branches are sub-angular. Dissepiments slender, depressed. Fenestrules much narrower than on the opposite face.

Cell apertures usually in two and three ranges, three ranges occurring on the greater portion of a branch, the central range strongly elevated, twenty in the space of 5 mm., nearly or quite in contact; margins strongly elevated, indenting the borders of the fenestrules. Ranges of apertures separated by more or less prominent ridges.

This species very closely resembles *F.* (*P.*) *fistulata* of the Hamilton group, but may be distinguished as follows: the branches are not angular, nor so strong, the dissepiments are more distant, and the branches on the celluliferous face are not so closely arranged, in that species the branches being frequently in contact.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Polypora) celsipora, var. minor.

PLATE XLI, FIGS. 14, 15.

Fenestella celsipora, var. *minor*, Hall. Trans. Albany Institute, vol. x, abstract, p. 24. 1881.
" (*Polypora*) *celsipora*, var. *minor*. Report of State Geologist for 1885, advance sheets. Expl. pl. 41, figs. 14, 15. 1886.

This form is very similar in appearance to *F. celsipora* proper, but the branches and dissepiments are smaller and more closely arranged.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Polypora) celsipora, var. minima.

PLATE XXXV, FIGS. 1-4; AND PLATE XLI, FIGS. 11-13.

Fenestella celsipora, var. *minima*, Hall. Trans. Albany Institute, vol. x, abstract, p. 24. 1881.
" (*Polypora*) *celsipora*, Hall. Report of State Geologist for 1882. Expl. pl. 28, figs. 1-4. 1883.
" " " var. *minima*, Hall. Report of State Geologist for 1885. Expl. pl. 41, figs. 11-13. 1886.

Bryozoum infundibuliform, compact. Branches slender, width above a bifurcation usually about .25 mm., increasing to .40 and .50 mm., but on some fronds the branches are stronger, rounded or angular. Interstices generally wider than the branches. Dissepiments slender, width .20 mm., rounded, on a plane with the branches, nine or ten in the space of 5 mm. Fenestrules usually sub-quadrangular, sometimes oval or circular, length about .35 mm., width usually from one-half to three-fourths the length, but frequently equalling or greater than the length.

On the celluliferous face the branches are gently rounded. Dissepiments extremely slender, rounded, depressed. Fenestrules much narrower than on the opposite face, frequently appearing as mere slits. Cell apertures in from two to four ranges, twenty-four in the space of 5 mm., distant less than the diameter of an aperture, sometimes nearly or quite in contact; margins strongly elevated; ranges sometimes separated by a narrow striation.

This variety will be easily recognized by the narrow interstices of the celluliferous face, the closely disposed apertures and their very prominent margins.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Polypora) adnata.

PLATE XLI, FIGS. 1-8, 10.

Fenestella adnata, Hall. Trans. Albany Institute, vol. x, abstract, p. 25. 1881.
" *(Polypora) adnata*, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 41, figs. 1-8, 10. 1886.

Bryozoum infundibuliform. Branches moderately slender, width above a bifurcation about .35 mm., increasing to .45 or .50 mm., very gradually enlarging, anastomosing or connected by very short dissepiments, sinuous or zig-zag, angular, carinated; carinæ slight, those of adjacent branches frequently uniting on the anastomosed portion. Bifurcations distant. Interstices slightly narrower than the branches. Dissepiments strong, width .65 or .70 mm., angular, on a plane with the branches, six in the space of 7 mm. Fenestrules oval, length .50 mm., width usually two-thirds the length, sometimes nearly equal to it. This face of the frond frequently presents a reticulated appearance.

The celluliferous face presents a more regular appearance, the branches are rounded, slightly sinuous, essentially parallel. Dissepiments rounded, depressed. Fenestrules smaller than on the opposite face. Cell apertures usually in three ranges, twenty-two in the space of 5 mm., nearly or quite in contact: margins strong. There are, occasionally, apertures much larger than the ordinary ones.

This species will be distinguished by the essentially parallel branches, scarcely increasing in size, and the peculiarly rigid appearance of the celluliferous face.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Polypora) elongata.

PLATE XLII, FIGS. 3, 4.

Fenestella (Polypora) elongata, Hall. Report of State Geologist for 1882. Expl. pl. 33, figs. 3, 4. 1883.

Bryozoum infundibuliform. Branches moderately strong, very gradually enlarging, width above a bifurcation .40 mm., increasing to .70 mm., flattened, sub-angular, with a comparatively strong, slightly elevated carina along the middle. Interstices of about the same width as the branches. Dissepiments slender, width .20 mm., angular, slightly depressed. Fenestrules oval, length 1.75 mm., width about .50 mm.

On the celluliferous face the branches are slightly rounded. Dissepiments rounded, much depressed. Fenestrules a little narrower than on the opposite face. Cell apertures in from two to four ranges, very minute, sixteen in the space of 5 mm., separated by twice the diameter of an aperture. Space between the apertures striated.

This species may be distinguished from *F. (P.) orbirama*, by its coarser appearance and its much larger fenestrules; from all other species by the flattened, carinated branches, the distance between the minute cell apertures and the striated surface.

Formation and locality. Upper Helderberg group, Onondaga Valley, Onondaga county, N. Y.

Fenestella (Polypora) carinella, n. sp.

PLATE XLII, FIGS. 1, 2.

Fenestella (Polypora) n. sp.? Hall. Report of State Geologist for 1882. Expl. pl. 33, figs. 1, 2. 1883.

Bryozoum infundibuliform. Branches moderately strong, width above a bifurcation .33 mm., increasing to .75 mm., gradually enlarging, straight or very slightly sinuous, angular, slightly carinated; bifurcations distant. Interstices narrower than the branches. Dissepiments very slender, width about

.20 mm., angular, slightly carinated, much depressed below the plane of the branches, about five in the space of 5 mm. Fenestrules oval, length about .80 mm., width from .35 to .40 mm.

On the celluliferous face the branches are rounded Dissepiments angular, slightly carinated, much depressed. Fenestrules a little narrower than on the opposite face. Cell apertures in two and three ranges, opening outward, sixteen in the space of 5 mm., separated by less than the diameter of an aperture, outer ranges slightly oblique to the axis of the branch; margins unequally elevated, the upper portion being the strongest: the apertures apparently open obliquely toward the base of the frond. Ranges of apertures separated by fine, slightly elevated, but very distinct ridges.

This species has a general resemblance to *F.* (*P.*) *elongata*, but the branches and dissepiments are smaller and more closely disposed, there being two dissepiments in the space occupied by one in that species.

Formation and locality. Upper Helderberg group, near Buffalo, N. Y.

Fenestella (Polypora) granilinea.

PLATE XL, FIGS. 20-23.

Fenestella granilinea, Hall. Trans. Albany Institute, vol. x, abstract, p. 27. 1881.
" (*Polypora*) *granilinea*, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 40, figs. 20-23. 1886.

Bryozoum infundibuliform, fronds large, compact. Branches slender, width above a bifurcation .38 mm., increasing to .55 or .60 mm., very gradually enlarging, essentially parallel, angular, with a row of granules along the middle resembling a carina, occasionally there are two or three lines of granules below bifurcations; bifurcations distant, usually occurring at intervals of from 30 to 50 mm. Interstices slightly narrower than the branches. Dissepiments slender, width .25 mm., rounded or angular, slightly depressed below the plane of the branches, eleven in the space of 10 mm. Fenestrules oval, length .65 mm., width .40 mm.

On the celluliferous face the branches are sub-angular. Dissepiments angular, carinated, depressed. Fenestrules narrower than on the opposite

face. Cell apertures in two and three ranges, fifteen in the space of 5 mm., separated by the diameter of an aperture, central range the most prominent. When only two ranges occur they are separated by a slightly elevated carina.

The general appearance of this species is similar to *F. parallela*, but the branches are larger, the dissepiments occur at less frequent intervals, and there are more than two ranges of cell apertures. From other forms it is distinguished by the distant bifurcations, and the straight, essentially parallel branches.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

b. Forms having three or more ranges of cell apertures.

FENESTELLA (POLYPORA) RIGIDA.

PLATE XXXIV, FIGS. 1-3.

Fenestella rigida, HALL. Trans. Albany Institute, vol. x, abstract, p. 22. 1881.
" (*Polypora*) *rigida*, HALL. Report of State Geologist for 1882. Expl. pl. 27, figs. 1-3. 1883.

BRYOZOUM infundibuliform. Branches moderately strong, angular, width above a bifurcation .50 mm., increasing to 1 mm.; bifurcations at intervals of from 10 to 20 mm. Interstices slightly narrower than the branches. Dissepiments slender, width .40 mm., four in the space of 5 mm., depressed below the plane of the branches and much expanded at their junction. Fenestrules broadly oval, width equal to two-thirds the length.

On the celluliferous face the branches are rounded and the dissepiments depressed. Fenestrules of the same appearance as on the opposite face. Cell apertures in from three to five ranges, which are separated by a slightly elevated, sinuous ridge; sixteen apertures in the space of 5 mm.

Formation and locality. Upper Helderberg group, near Thompson's lake, Albany county, N. Y.

Fenestella (Polypora) robusta.

PLATE XXXIV, FIGS 4-7; PLATE XXXVII, FIG. 1; PLATE XXXIX, FIGS. 1-3; AND PLATE XLVI, FIG. 6.

Fenestella robusta, Hall. Trans. Albany Institute, vol. x, abstract, p. 22. 1881.
" *(Polypora) robusta.* Report of State Geologist for 1882. Expl. pl. 27, figs. 4–7; pl. 30, fig. 1; pl. 32, figs. 1–3. 1883.

Bryozoum infundibuliform. Branches very strong, angular, sometimes with a slight carina; width just above a bifurcation .66 mm., increasing to 1.50 mm; bifurcations usually occur at intervals of from 20 to 50 mm. Interstices slightly wider than the branches. Dissepiments .66 mm. wide, four or five in the space of 5 mm., on the same plane with the branches and expanding at their junction. Fenestrules broadly oval.

On the celluliferous face the branches are rounded. Dissepiments rounded or sub-angular, much depressed. Fenestrules elongate-oval, narrower than on the opposite face. Cell apertures in from four to seven ranges, eighteen in the space of 5 mm., separated longitudinally by slightly less than the diameter of an aperture; transversely they are nearly or quite in contact; margins strong, equally elevated.

This is a characteristic species and will be easily distinguished from the associated forms, by the large size and rigid appearance of the branches.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Polypora) largissima.

PLATE XXXIV, FIGS. 8, 9.

Fenestella largissima, Hall. Trans. Albany Institute, vol. x, abstract, p 22. 1881.
" *(Polypora) largissima*, Hall. Report of State Geologist for 1882. Expl. pl. 27, figs. 8, 9. 1883.

Bryozoum infundibuliform, of coarse and irregular growth. Branches strong, angular, width above a bifurcation .90 mm., increasing to 1.50 or 2 mm.; bifurcations at intervals of from 6 to 10 mm. Dissepiments strong, width about 1 mm. Fenestrules sub-quadrangular or oval, variable in appearance, length from 2 to 4 mm., width from 1 to 1.50 mm. Cell apertures in four to six ranges.

This species may be distinguished by the large size of the branches and dissepiments and its irregular growth.

Formation and locality. Upper Helderberg group. Corniferous limestone, Central New York.

Fenestella (Polypora) propria.

PLATE XXXIV, FIGS. 10–13.

Fenestella propria, Hall. Trans. Albany Institute, vol. x, abstract, p. 22. 1881.
" " " Report of State Geologist for 1882. Expl. pl. 27, figs. 10–13. 1883.

Bryozoum infundibuliform, of lax growth, fronds large. Branches moderately strong, sinuous, angular, carinated, width above a bifurcation .50 mm., increasing to .90 mm.; bifurcations at intervals of from 8 to 30 mm., seldom less than 12 mm. Interstices wider than the branches. Dissepiments slender, angular, carinated, width .33 mm., four or five in the space of 5 mm., slightly depressed below the plane of the branches and much expanded at their junction. Fenestrules sub-quadrangular or oval, length from 1.75 to slightly more than 2 mm., width about one-half the length.

On the celluliferous face the branches are rounded. Dissepiments angular, carinated, depressed. Fenestrules of the same appearance as on the opposite face. Cell apertures usually in three and four ranges, sixteen in the space of 5 mm., separated by slightly more than the diameter of an aperture, situated on low, rounded ridges.

This species may be distinguished by the lax appearance of the frond, the frequently sinuous, angular, strongly carinated branches on the non-celluliferous face, and the low rounded ridges of the celluliferous face of the branches, in which respects it differs from any other species of this formation.

Formation and locality. Upper Helderberg group, near Buffalo, N. Y.

Fenestella (Polypora) aculeata.

PLATE XXXV, FIGS. 5–7; AND PLATE XL, FIGS. 6–11.

Fenestella aculeata, Hall. Trans. Albany Institute, vol. x, abstract, p. 21. 1881.
" (*Polypora*) *aculeata*, Hall Report of State Geologist for 1882. Expl. pl. 28, figs. 5–7. 1883.
" " " " Report of State Geologist for 1885, advance sheets. Expl. pl. 40, figs. 6–11. 1886.

Bryozoum infundibuliform, arising from a broadly spreading striated base; pedicel short, thick. Branches moderately strong, width above a bifurcation

.33 mm., gradually increasing to .50 mm.; near the base stronger, rounded, with numerous strong, conical, irregularly disposed nodes; bifurcations at intervals of from 6 to 15 mm. Interstices of about the same width as the branches. Dissepiments comparatively strong, width from .40 to .50 mm., rounded, smooth, five in the space of 5 mm., on the same plane with the branches, slightly expanded at their junction. Fenestrules oval, width equal to one-half the length.

On the celluliferous face the branches are angular, becoming rounded below a bifurcation. Dissepiments angular depressed. Fenestrules slightly narrower than on the opposite face. Cell apertures in from two to four ranges, fifteen in the space of 5 mm., separated by less than the diameter of an aperture; ranges of apertures separated by ridges with numerous, prominent, conical nodes.

This species may be easily distinguished by the prominent nodes and the longitudinal ridges separating the rows of apertures.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Polypora) quadrangularis.

PLATE XXXV, FIGS. 8-13; PLATE XXXVI, FIGS. 23, 24; AND PLATE XL, FIGS. 1, 2.

Fenestella quadrangularis, Hall. Trans. Albany Institute, vol. x, abstract, p. 21. 1881.
" (*Polypora*) *quadrangularis*, Hall. Report of State Geologist for 1882. Expl. pl. 28, figs. 8-13; pl. 29, figs. 23, 24. 1883.
" " " " Report of State Geologist for 1885, advance sheets. Expl. pl. 40, figs. 1, 2. 1886.

Bryozoum infundibuliform. Branches strong, width above a bifurcation .50 increasing to 1 mm., angular, carinated; carina broad, angular, with prominent, conical nodes, which usually occur opposite dissepiments, but are sometimes irregularly disposed; bifurcations at intervals of from 8 to 15 mm. Interstices narrower than the branches, sometimes less than half the width. Dissepiments strong, width .50 to .60 mm., angular, carinated, slightly depressed below the plane of the branches, five in the space of 5 mm. Fenestrules regularly oval, width equal to two-thirds the length.

On the celluliferous face the branches are rounded. Dissepiments rounded, depressed. Fenestrules of the same size as on the opposite face. Cell aper-

tures in from three to six ranges, eighteen in the space of 5 mm., separated by less than the diameter of an aperture. On some fronds, especially near the base, there are prominent, irregularly disposed nodes.

The non-celluliferous face of this species so nearly resembles that of *F.* (*P.*) *lævistriata*, that a satisfactory determination cannot always be made; usually the fenestrules are more elongate-oval. On the celluliferous face this species may be distinguished by the more prominent cell apertures, their closer disposition and the absence of striations separating the ranges of apertures.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Polypora) lævistriata.

PLATE XXXV, FIGS. 14-16.

Fenestella (*Polypora*) *lævistriata*, Hall. Report of State Geologist for 1882. Expl. pl. 28, figs. 14-16. 1883.

Bryozoum infundibuliform. Branches strong, width above a bifurcation .50 mm., increasing to 1 mm., angular, carinated; carinæ with prominent, conical nodes, which usually occur opposite the dissepiments, but are sometimes irregularly disposed. Interstices narrower than the branches, sometimes not more than half the width. Dissepiments comparatively slender, width .33 mm., five in the space of 5 mm., on a plane with the branches. Fenestrules oval, length .60 mm., width about one-half the length.

On the celluliferous face the branches are gently rounded. Dissepiments rounded, depressed. Fenestrules of the same size as on the opposite face. Cell apertures in from two to four ranges, eighteen in the space of 5 mm., separated by slightly more than the diameter of an aperture; margins distinctly elevated. Ranges of apertures separated by slight ridges.

The non-celluliferous face of this species so closely resembles that of *F.* (*P.*) *quadrangularis*, that it is difficult to distinguish them. On the celluliferous face the apertures are smaller, more distant and more distinctly arranged in longitudinal rows, which are separated by ridges.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Polypora) cultellata.

PLATE XXXVI, FIGS. 3–22; AND PLATE XLI, FIG. 9.

Fenestella cultellata, Hall. Trans. Albany Institute, vol. x, abstract, p. 21. 1881.
" (*Polypora*) *cultellata*, Hall. Report of State Geologist for 1882. Expl. pl. 29, figs. 3–22. 1883.
" " " " Report of State Geologist for 1885, advance sheets. Expl. pl. 41, fig. 9. 1886.

Bryozoum infundibuliform, fronds large, strong; near the base there are usually elongate projections, which frequently have their distal extremities attached to foreign substances, serving as additional supports to the frond. Branches moderately strong, width above a bifurcation .40 mm., increasing to 1 mm. or slightly more; angular when perfectly preserved, with a slight carina and occasionally with prominent, oblique, conical nodes; when slightly worn or macerated they are rounded or flattened and smooth; bifurcations near the base at intervals of from 10 to 25 mm., at some distance above, from 30 to 90 mm. Interstices narrower than the branches. Dissepiments slightly oblique, width .50 mm., five or six in the space of 5 mm., on the same plane and much expanded at their junction with the branches. Fenestrules broadly oval, sometimes nearly circular, length about .50 mm.

On the celluliferous face the dissepiments are rounded and depressed, very frequently traversed by narrow channels with sharp margins, which extend for a short distance on the branches. Fenestrules narrower than on the opposite face. Cell apertures in from three to seven ranges, eighteen in the space of 5 mm., very closely disposed, usually in contact; margins distinctly elevated. At frequent intervals along the middle of the branch the margins of the apertures are prolonged into elongate, sharp, node-like elevations, having a height of about .50 or .60 mm. and a length of .75 mm.

This species is very abundant at the locality cited, and may be readily distinguished by the peculiar elevations on the celluliferous face, and the channels traversing the dissepiments.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Polypora) distans.

PLATE XXXVII, FIGS. 2-10, 15, 16; AND PLATE XLIV, FIG. 7.

Fenestella distans, Hall. Trans. Albany Institute, vol. x, abstract, p. 24. 1881.
" (*Polypora*) *distans*, Hall. Report of State Geologist for 1882. Expl. pl. 30, figs. 2–5, 15, 16. 1883.
" " " " ? Report of State Geologist for 1882. Expl. pl. 30, figs. 6–10. 1883.
" " " " Report of State Geologist for 1885, advance sheets. Expl. pl. 44, fig. 7. 1886.

Bryozoum consisting of infundibuliform fronds of somewhat lax and irregular growth. Branches strong, width above a bifurcation .50 mm., increasing to 1 or 1.50 mm., acutely angular, with small nodes, occurring at irregular intervals. Interstices equal in width or wider than the branches. Dissepiments comparatively slender, width .40 mm., rounded or sub-angular, four or five in the space of 10 mm. Fenestrules sub-quadrangular or oval, width variable, usually from 1 to 1.50 mm.

On the celluliferous face the branches are rounded. Dissepiments flattened, depressed, generally traversed by a shallow channel, which does not extend upon the branches. Fenestrules narrower than on the opposite face. Cell apertures in from three to six ranges, fourteen in the space of 5 mm., nearly in contact; ranges separated by a narrow sinuous ridge; margins slightly elevated. When worn or macerated, the cell margins and intermediate ridges are obsolete, the apertures appearing immersed and in contact; disposed in quincunx order.

Formation and locality. Upper Helderberg group, near Buffalo, N. Y.

Fenestella (Polypora) flabelliformis.

PLATE XXXVII, FIGS. 11, 12.

Fenestella flabelliformis, Hall. Trans. Albany Institute, vol. x, abstract, p. 23. 1881.
" (*Polypora*) *flabelliformis*, Hall. Report of State Geologist for 1882. Expl. pl 30, figs. 11, 12. 1883.

Bryozoum flabelliform, non-celluliferous face not observed.

On the celluliferous face the branches are moderately strong; width above a bifurcation .50 mm., increasing to 1 mm., rounded. Interstices wider than

the branches. Dissepiments slender, width .30 mm., rounded, depressed. Fenestrules sub-quadrangular, length generally a little more than 2 mm., width from .70 to .90 mm. Cell apertures minute, in from three to five ranges, fourteen in the space of 5 mm., separated by more than the diameter of an aperture; margins slightly elevated, and separated by comparatively prominent, gently sinuous ridges.

This species will be readily distinguished, as it is the only flabellate form at present known, from this geological formation.

Formation and locality. Upper Helderberg group, Onondaga Valley, Onondaga county, N. Y.

Fenestella (Polypora) perangulata.

PLATE XXXVII, FIGS. 13, 14.

Fenestella perangulata, Hall. Trans. Albany Institute, vol. x, abstract; p. 23. 1881.
" (*Polypora*) *perangulata*, Hall. Report of State Geologist for 1882. Expl. pl. 30, figs. 13, 14. 1883.

Bryozoum infundibuliform. Branches strong, width above a bifurcation .50 mm., increasing to .80 or .90 mm., acutely angular, with a very slight carina, which is sometimes sinuous. Interstices wider than the branches. Dissepiments comparatively slender, width .40 mm., angular, carinated, depressed, about three in the space of 5 mm. Fenestrules oval, length 1 mm., width usually about .70 mm., but sometimes the fenestrules are nearly circular; at other times the width is not more than half the length.

The celluliferous face has not been observed.

This species may be distinguished from *F.* (*P.*) *rigida* by the coarser appearance of the frond, and from *F.* (*P.*) *distans*, by the more compact growth of the frond and the oval fenestrules.

Formation and locality. Upper Helderberg group, Western New York.

Fenestella (Polypora) porosa.

PLATE XXXVIII, FIGS. 1-6.

Fenestella porosa, Hall. Trans. Albany Institute, vol. x, abstract, p. 26. 1881.
" (*Polypora*) *porosa*, Hall. Report of State Geologist for 1882. Expl. pl. 31, figs. 1-6. 1883.

Bryozoum infundibuliform, fronds large, somewhat rigid in appearance, rapidly expanding. Branches moderately strong, width above a bifurcation .33 mm., increasing to .70 mm., angular, slightly carinated. Interstices slightly narrower than the wider portion of the branches. Dissepiments comparatively strong, width .33 mm., angular, slightly carinated, on the same plane with the branches, four in the space of 5 mm. Fenestrules regularly oval, height .60 mm., width usually about .40 mm.

On the celluliferous face the branches are rounded. Dissepiments angular, carinated, slightly depressed. Fenestrules much narrower than on the opposite face, length from two to three times the width. Cell apertures in three and four ranges, sixteen in the space of 5 mm., separated by a little more than the diameter of an aperture.

This species may be distinguished from *F.* (*P.*) *hexagonalis*, by the smaller size and closer arrangement of branches and dissepiments; from *F.* (*P.*) *nexa* and *F.* (*P.*) *mutabilis* by the stronger and more compact appearance of the frond and absence of ridges separating the ranges of apertures.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Polypora) perundata.

PLATE XXXVIII, FIGS. 7-13.

Fenestella perundata, Hall. Trans. Albany Institute, vol. x, abstract, p. 27. 1881.
" (*Polypora*) *perundata*, Hall. Report of State Geologist for 1882. Expl. pl. 31, figs. 7-13. 1883.

Bryozoum infundibuliform, fronds large, with frequent, strong, radial folds or undulations. Branches strong, width above a bifurcation .60 mm., increasing to 1 mm., angular or with a slight carina, anastomosing, sinuous or zig-zag, irregular, the face often presenting a reticulated appearance. Interstices

slightly wider than the branches. Fenestrules oval, length usually about 1.50 mm., width two-thirds the length.

On the celluliferous face the branches are rounded, sinuous, never zig-zag. The anastomosed portion is depressed below the center of the branches. Fenestrules narrower than on the opposite face. Cell apertures in from three to five ranges, sixteen in the space of 5 mm., separated by less than half the diameter of an aperture; margins strongly elevated.

This species most closely resembles *F. hexagonalis*, but may be distinguished by its coarser growth; from *F. robusta*, it may be distinguished by the zig-zag, anastomosing branches on the non-celluliferous face.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Polypora) hexagonalis.

PLATE XXXVIII, FIGS. 14–20.

Fenestella hexagonalis, Hall. Trans. Albany Institute, vol. x, abstract, p. 27. 1881.
" (*Polypora*) *hexagonalis*, Hall. Report of State Geologist for 1882. Expl. pl. 31, figs. 14–20. 1883.

Bryozoum infundibuliform, fronds large. Branches strong, very gradually enlarging, width above a bifurcation .50 mm., increasing to .75 mm., angular, with a slight carination, usually sinuous, sometimes anastomosing; bifurcations usually occur at intervals of from 20 to 50 mm. Interstices slightly wider than the branches. Dissepiments strong, width from .50 to .70 mm., three in the space of 5 mm., angular, carinated, on a plane with the branches. Fenestrules oval, length usually about 1 mm., width .60 mm.

On the celluliferous face the branches are rounded and sinuous. Dissepiments rounded, depressed. Fenestrules narrower than on the opposite face, width about .40 mm. Cell apertures in from two to four ranges, sixteen in the space of 5 mm., closely disposed, frequently in contact; margins distinctly elevated. The central range is often very prominent.

This species may be distinguished from *F.* (*P.*) *perundata*, by the smaller and more regular branches, which are usually connected by dissepiments; from the

other associated species of this geological formation, it differs in having angular, sinuous branches, and in the size of the branches and fenestrules.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Polypora) hexagonalis, var. foraminulosa.

PLATE XXXIX, FIGS. 16-20.

Fenestella hexagonalis, var. *foraminulosa*, Hall. Trans. Albany Institute, vol. x, abstract, p. 27. 1881.
" (*Polypora*) *hexagonalis*, var. *foraminulosa*, Hall. Report of State Geologist for 1882. Expl. pl. 32, figs. 16-20. 1883.

This variety is very similar to the ordinary forms of *F.* (*P.*) *hexagonalis*, but on the celluliferous face it has numerous, very prominent, hollow, conical nodes.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Polypora) nexa.

PLATE XXXIX, FIGS. 4-9.

Fenestella nexa, Hall. Trans. Albany Institute, vol. x, abstract, p. 25. 1881.
" (*Polypora*) *nexa*, Hall. Report of State Geologist for 1882. Expl. pl. 32, figs. 4-9. 1883.

Bryozoum infundibuliform. Branches moderately strong, very gradually increasing in size, width above a bifurcation .33 mm., increasing to .65 mm., angular, slightly carinated, very seldom sinuous. Interstices usually a little wider than the branches. Dissepiments comparatively slender, width .33 mm., angular, slightly carinated, on a plane with the branches, about three in the space of 5 mm. Fenestrules oval, length about 1.20 mm., width .50 mm.

On the celluliferous face the branches are rounded. Dissepiments angular, slightly carinated, much depressed. Fenestrules narrower than on the opposite face, the interstices being slightly narrower than the branches. Cell apertures in from two to four ranges, sixteen in the space of 5 mm., separated by about the diameter of an aperture; where only two ranges of apertures occur, they are separated by a slightly elevated carina.

This species may be distinguished from *F.* (*P.*) *separata* by the somewhat more lax appearance of the frond, the more slender and less frequent branches and dissepiments.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Polypora) separata.

PLATE XXXIX, FIGS. 10, 11.

Fenestella (Polypora) separata, Hall. Report of State Geologist for 1882. Expl. pl. 32, figs. 10, 11. 1883.

Bryozoum infundibuliform. The non-celluliferous face has not been observed.

On the celluliferous face the branches are moderately strong, width above a bifurcation .35 mm., increasing to 1 mm. Interstices narrower than the branches. Dissepiments comparatively strong, width .40 mm., rounded, slightly depressed, with a faint carina, three in the space of 5 mm. Fenestrules elongate-oval, length 1 mm., width a little less than .40 mm. Cell apertures in from two to four ranges, eighteen in the space of 5 mm., separated by less than the diameter of an aperture; margins distinctly elevated. Ranges of apertures separated by narrow prominent ridges.

This species may be distinguished from *F. (P.) mutabilis* by the more rigid appearance of the frond, straighter branches and prominent ridges separating the ranges of apertures.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Polypora) mutabilis.

PLATE XXXIX, FIGS. 12-15.

Fenestella mutabilis, Hall. Trans. Albany Institute, vol. x, abstract, p. 25. 1881.
" *(Polypora) mutabilis*, Hall. Report of State Geologist for 1882. Expl. pl. 32, figs. 12-15. 1883.

Bryozoum infundibuliform, of lax and irregular growth. Branches moderately strong, width above a bifurcation from .33 to .40 mm., increasing to .60 and .70 mm., straight, sinuous or zig-zag, according to the position of the dissepiments; on some portions of the frond angular and carinated, becoming flattened below a bifurcation; on other portions rounded, with three or four prominent striations. Interstices of the same width as the branches. Dissepiments comparatively strong, width .35 mm., angular or carinated, on the same plane as the branches, four in the space of 5 mm. Fenestrules oval, length slightly less than 1 mm., width .45 mm.

On the celluliferous face the branches are rounded. Dissepiments rounded, depressed. Fenestrules narrower than on the opposite face. Cell apertures

in two and three ranges, seventeen in the space of 5 mm, separated by a little less than the diameter of an aperture.

This species may be distinguished from others, having branches and dissepiments of about the same size, by its irregular growth and the prominent striations on the branches of a portion of the frond.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestllla (Polypora) submutans.

PLATE XL, FIGS. 3-5.

Fenestella submutans, Hall. Trans. Albany Institute, vol. x, abstract, p. 21. 1881.
" *(Polypora) submutans*, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 40, figs. 3-5. 1886.

Bryozoum infundibuliform. Branches moderately strong, width above a bifurcation .33 mm., increasing to .60 mm., somewhat irregular, rounded or sub-angular, sometimes slightly carinated. Interstices narrower than the branches. Dissepiments comparatively strong, width .35 mm., sometimes oblique to the branch, rounded or sub-angular, occasionally slightly carinated, on a plane with the branches, occurring at irregular intervals. Fenestrules variable in form, sub-oval, immediately above a bifurcation lanceolate, length about 1 mm., width from .25 to .50 mm.

On the celluliferous face the branches are rounded. Dissepiments rounded, a little depressed. Fenestrules slightly narrower than on the opposite face. Cell apertures in from three to five ranges, opening outward and laterally, eighteen in the space of 5 mm., separated by less than the diameter of an aperture; margins distinctly elevated, strongly indenting the borders of the fenestrules and visible from the opposite face of the frond. Ranges of apertures separated by low, rounded ridges; the ridges and surface between apertures with numerous, small, conical nodes.

This species most nearly resembles *F. (P.) aculeata*, but the frond is more irregular, the branches more slender, and the fenestrules more elongate.

Formation and localtiy. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Polypora) brevisulcata.

PLATE XL, FIGS. 12-15.

Fenestella brevisulcata, Hall. Trans. Albany Institute, vol. x, abstract, p. 26. 1881.
" (*Polypora*) *brevisulcata*. Report of State Geologist for 1885, advance sheets. Expl. pl. 40, figs. 12-15. 1886.

Bryozoum infundibuliform, fronds large. Branches moderately slender, width above a bifurcation .33 mm., increasing to .66 mm., angular or sub-angular, becoming flattened, and concave immediately below a bifurcation, with a row of small nodes at irregular intervals, along the middle of the branch, which is occasionally carinated; bifurcations distant. Interstices wider than the branches. Dissepiments comparatively strong, width .30 mm., rounded, very slightly depressed below the plane of the branches, five in the space of 9 mm. Fenestrules oval, length about 1.25 mm., width from .40 to .60 mm.

On the celluliferous face the branches are rounded. Dissepiments rounded, depressed. Fenestrules of the same size as on the opposite face. Cell apertures in three and four ranges, sixteen in the space of 5 mm., separated by less than the diameter of an aperture.

This species may be distinguished by its angular branches, which become flattened as they increase in size and have a depression along the middle, immediately below a bifurcation.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Polypora) striatopora.

PLATE XL, FIGS. 16-19.

Fenestella striatopora, Hall. Trans. Albany Institute, vol. x, abstract, p. 23. 1881.
" (*Polypora*) *striatopora*, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 40, figs. 16-19. 1886.

This form very closely resembles *F.* (*P.*) *quadrangularis*, and may possibly be only a variety of that species. The longitudinal disposition of the cell apertures is very distinct, the ranges sometimes being separated by comparatively prominent ridges; at other times the margin of one side of the cell aperture is very strongly elevated, coalescing with adjacent margins longitudinally, and forming an elevation which has the appearance of a prominent ridge separating the ranges of apertures.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Polypora) lævinodata.

PLATE XLII, FIGS. 12–15.

Fenestella levinodata, Hall. Trans. Albany Institute, vol. x, abstract, p. 28. 1881.
" (*Polypora*) *lævinodata*, Hall. Report of State Geologist for 1885, advance sheets. Expl. pl. 33, figs. 12–15. 1883.

Bryozoum infundibuliform. Branches moderately slender, width above a bifurcation .35 mm., increasing to .50 mm., straight or sinuous, angular, with a very slight carina. Interstices wider than the branches. Dissepiments strong, width .50 mm. or more, angular, carinated, on a plane with the branches, six or seven in the space of 5 mm. Fenestrules oval, length 1.20 mm., width .60 mm. or slightly more.

On the celluliferous face the branches are rounded. Dissepiments very short, width .65 to .70 mm., depressed. Fenestrules smaller than on the opposite face. Cell apertures in from three to five ranges, twenty in the space of 5 mm., distant less than the diameter of an aperture. Ranges of apertures separated by slightly elevated ridges.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Fenestella (Polypora) rustica, n. sp.

PLATE XLIII, FIGS. 10–13.

Bryozoum infundibuliform, fronds large, irregular. Branches strong, width above a bifurcation .75 mm., increasing to from 1.60 to 2 mm., sometimes straight, but frequently irregular, rounded; sometimes the surface is concave immediately below a bifurcation; on the specimens observed it is smooth; bifurcations comparatively frequent. Interstices as wide or wider than the branches. Dissepiments strong, width .85 mm., rounded, very nearly on a plane with the branches and frequently oblique to them, occurring at irregular intervals. Fenestrules varying in shape, usually sub-quadrangular or oval, often lanceolate immediately above a bifurcation, length from 2.50 to 4 mm., width from .75 to 1.25 mm., occasionally a little narrower.

On the celluliferous face the branches are rounded or sub-angular. Dissepiments rounded, sometimes slightly carinated, much depressed. Fenes-

trules narrower than on the opposite face. Cell apertures in from three to six ranges, usually either four or six ranges, opening outward and laterally; twelve in the space of 5 mm., separated by less than half the diameter of an aperture: margins equally elevated. There is usually a prominent, rounded ridge along the middle of the branch, which is smooth or nodose.

This species may be distinguished from nearly all others of this geological formation, by the size of the branches, dissepiments and fenestrules; it is the only form of Polypora, at present known, having a prominent, nodose ridge along the middle of the branch. The only species to which it has a close resemblance is *F.* (*P.*) *largissima*, but the branches are a somewhat more slender, the bifurcations more distant, the fenestrules narrower and the whole frond, though irregular, is much more regular than in that species.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Polypora) crebescens.

PLATE XLV, FIGS. 20, 21.

Fenestella crebescens, Hall. Report of State Geologist for 1883, advance sheets. Expl. pl. 45, figs. 20, 21. 1886.

Bryozoum infundibuliform. Branches moderately strong, width above a bifurcation .35 mm., increasing to .65 mm., rounded, rigid, with prominent nodes, which are irregularly disposed and frequently occurring opposite a dissepiment. Interstices narrower than the branches. Dissepiments strong, width .35 mm., rounded, slightly depressed, eleven in the space of 5 mm. Fenestrules oval, length about .55 mm., width from one-half to two-thirds the length.

Celluliferous face not observed.

This species is referred to the genus Polypora on account of the comparatively great width of the branches, which indicate the existence of more than two ranges of cellules.

Formation and locality. Upper Helderberg group, Western New York.

PTILOPORELLA, s. g., Hall. 1885.

Fenestella (Ptiloporella) laticrescens, n. sp.

NOT FIGURED.

Bryozoum infundibuliform, composed of primary and secondary branches. The celluliferous face of this species only has been observed. Branches straight or very slightly sinuous, width of primary branches about .50 mm., of secondary ones .33 mm., some of the secondary branches greatly increase in size, the others continue for their entire length without enlarging. Interstices of the same width as the smaller branches. Dissepiments comparatively strong, width .35 mm., gently rounded, very much depressed, three in the space of 4 mm. Fenestrules regularly oval, length slightly less than 1 mm., width .33 mm. Cell apertures in two ranges, minute, opening directly outward, separated by one and one-half times the diameter of an aperture. Surface between ranges of apertures carinated, on the primary branches carinæ strong, height .50 mm., expanded at the summit to a width of .45 mm., and slightly carinated; carinæ on the secondary branches comparatively thin, height .35 mm., summit not expanded.

This species may be distinguished from *F.* (*Ptiloporina*) *sinistralis* by its having only two ranges of cell apertures, from *F.* (*Ptiloporina*) *disparilis* by the larger size of the branches, dissepiments and fenestrules.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Ptiloporella) inequalis, n. sp.

NOT FIGURED.

Bryozoum infundibuliform, composed of primary and secondary branches, primary branches .45 mm. wide, the secondary ones .20 mm., straight, rounded, the primary branches elevated about .25 mm. above the others. Interstices very slightly wider than the secondary branches. Dissepiments comparatively strong, width .18 mm., rounded, sometimes slightly carinated, nearly on a plane with the branches, sometimes elevated above and continuing across the branch, coalescing with adjacent dissepiments and forming continuous,

irregular, transverse elevations, nine in the space of 5 mm., which, though prominent, do not obscure the branches. Fenestrules oval, length about .38 mm., width .25 mm.

The celluliferous face of this species has not been observed, but the species may easily be distinguished from any other at present known by the smaller branches, dissepiments and fenestrules, and the much more compact appearance of the frond.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

PTILOPORINA, s. g., Hall. 1885.

Fenestella (Ptiloporina) conica, n. sp.

PLATE XLIII, FIGS. 2-4.

Bryozoum infundibuliform, rapidly expanding, composed of primary and secondary branches. The primary branches are very frequent, strongly elevated above the others, width .50 mm.; secondary branches about .30 mm. wide, all angular and slightly carinated. On one side of a frond, for some distance above the base, all the branches are large and directly connected by dissepiments. Interstices wider than the primary branches. Dissepiments very slender, width .20 mm., angular, slightly carinated, much depressed, three or four in the space of 5 mm. Fenestrules sub-quadrangular, length 1 to 1.25 mm., width .35 to .50 mm. Cell apertures in two or three ranges, sixteen in the space of 5 mm.

This species can be distinguished from the others of this sub-genus, by the numerous primary branches, slender dissepiments and large fenestrules.

Formation and locality. Upper Helderberg group, Schoharie, N. Y.

Fenestella (Ptiloporina) pinnata, n. sp.

PLATE XLIII, FIGS. 5, 6.

Bryozoum infundibuliform, composed of primary and secondary branches. Primary branches distant, width .50 mm., width of secondary branches .35 or .40 mm., all angular and slightly carinated. Interstices wider than the branches.

Dissepiments slender, width .25 mm., rounded, sometimes slightly carinated, depressed below the plane of the branches, four in the space of 5 mm. Fenestrules broadly oval, somewhat variable in size, length usually about 1 mm., width from .35 to .50 mm.

Celluliferous face not observed.

This species may be distinguished from the others of this sub-genus by the comparatively wide interstices, and the size of the secondary branches; also by their great divergence, which gives to each primary branch, with its lateral secondary branches from it, a pinnate appearance.

Formation and locaity. Upper Helderberg group, Schoharie, Schoharie county, N. Y.

FENESTELLA (PTILOPORINA) DISPARILIS, n. sp.

PLATE XLIII, FIGS. 7, 8.

BRYOZOUM infundibuliform, of coarse appearance, composed of primary and secondary branches; primary branches .70 mm. wide; the secondary ones .40 mm., increasing to .50 mm., probably on larger fronds some of the secondary branches would increase to .70 mm.; secondary branches straight; primary branches sinuous, all angular, slightly carinated, the primary branches elevated about .40 mm. above the others. Interstices of the same width or wider than the secondary branches. Dissepiments slender, width .25 mm., angular, slightly carinated, depressed below the plane of the branches, about five in the space of 5 mm. Fenestrules oval, length .75 mm., width .40 mm.

On the celluliferous face the dissepiments are rounded, much depressed. Fenestrules of the same appearance as on the opposite face. Cell apertures of the primary branches in from three to five ranges, those of the secondary branches in from two to three ranges, opening outward and laterally, eighteen in the space of 5 mm., closely disposed.

On the celluliferous face this species may be distinguished from *F.* (*Ptiloporella*) *laticrescens* by the stronger branches and larger fenestrules, the sinuous character of the primary branches and less frequent dissepiments, the number of branches being nearly the same.

Formation and locality. Upper Helderberg group, Walpole, Ontario, Canada.

Fenestella (Ptiloporina) sinistralis, n. sp.

PLATE XLIII, FIG. 9.

Bryozoum infundibuliform, length of the largest fragment observed 65 mm. with a width of 75 mm. The primary branches, commencing at the base, do not increase in size, but have a uniform width of about .60 mm.; the secondary branches have a width of about .30 mm., some of these, on the fragments observed, continuing their entire length without increase in size, while others attain a width of .60 mm. and have smaller lateral branches; all these are straight, angular and slightly carinated; the primary branches are strongly elevated above the others. Interstices a little wider than the secondary branches. Dissepiments slender, width about .35 mm., angular, slightly carinated, on a plane with the secondary branches, six in the space of 5 mm. Fenestrules oval, length a little less than .60 mm., width .35 to .40 mm.

On the celluliferous face the dissepiments are rounded and depressed. Fenestrules slightly narrower than on the opposite face. Cell apertures in from two to five ranges, two ranges occur only immediately above a bifurcation, opening outward and laterally, eighteen in the space of 5 mm., separated by less than the diameter of an aperture: margins elevated, indenting the borders of the fenestrules.

This species may be distinguished from *F.* (*Ptiloporina*) *disparilis* by its secondary branches, dissepiments and fenestrules, and the more compact appearance of the frond; from *F.* (*Ptiloporella*) *laticrescens* by its secondary branches, closer disposition of the dissepiments, and by the greater number of ranges of cell apertures, that species having only two ranges; from *F.* (*Ptiloporella*) *inequalis* it is distinguished by its larger branches, dissepiments and fenestrules, the greater number of ranges of cell apertures, that species having only two ranges, and by the coarser appearance of the frond. From all other similar species, at present known, in the fact that the secondary branches proceed only from the left side of the primary branches.

Formation and locality. Upper Helderberg group, Schoharie grit, Schoharie, N. Y.

HAMILTON GROUP.

DESCRIPTIONS OF SPECIES.

TREMATOPORA, HALL. 1852.

TREMATELLA, S. G., HALL. 1886.

(See pages 15 and 69.)

TREMATOPORA (TREMATELLA) PERSPINULATA.

NOT FIGURED.

Trematopora perspinulata, HALL. Trans. Albany Institute, vol. x, p. 181. 1881.
" " " Report of State Geologist for 1883, p. 11. 1884.

ZOARIUM ramose, solid; bifurcations infrequent; branches diverging at an angle of forty-five degrees, diameter from 1.50 to 3 mm. Cells tubular, apparently polygonal, arising from the center of the branch and gradually curving to the surface. Cell apertures from elongate-oval to nearly circular, variable in size, some having a length of .30 mm., and a width of .15 mm., others are nearly circular and have a diameter of about .28 mm., closely and irregularly disposed; all intermediate forms occur. Peristomes usually obsolete, and when occurring are very slight. Inter-apertural space, sometimes flat, at other times a little elevated and with a very slight striation, occasionally granulose. There are numerous, prominent, conical nodes or spinules, irregularly disposed, forming a prominent feature of the surface.

The irregular size and shape of the cell apertures, and the numerous, comparatively prominent spinules, will distinguish this species from any other at present known, from this geological horizon.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

Trematopora (Trematella) nodosa, n. sp.

NOT FIGURED.

Zoarium ramose, solid; bifurcations infrequent; branches diverging at an angle of forty-five degrees, diameter 2 mm. Cells tubular, arising from the center of the branch, in contact for nearly their entire length, gradually diverging until near the surface, when they abruptly turn outward; septa moderately frequent. Cell apertures oval, length .30 mm., width a little more than one-half the length, closely and irregularly disposed, separated by about one-third the width of an aperture. Peristomes obsolete, the apertures appearing immersed. Inter-apertural space elevated, convex, with numerous, prominent, slightly oblique, conical nodes.

The irregularly reticulated appearance of the surface, oval cell apertures and numerous, prominent, slightly oblique nodes, will be sufficient to distinguish this species from any other at present known in this geological horizon.

Formation and locality. Hamilton group, Jaycox's run, between Geneseo and Avon, N. Y.

ORTHOPORA, s. g.

(See pages 16 and 70.)

Trematopora (Orthopora) polygona.

NOT FIGURED.

Trematopora polygona, Hall. Trans. Albany Institute, vol. x, p. 180. 1881.
" " " Report of State Geologist for 1883, p. 9. 1884.

Zoarium ramose; bifurcations infrequent; branches widely diverging, diameter from 1.25 to 1.50 mm. Cells tubular, arising from the center of the branch, in contact for the greater portion of their length, somewhat abruptly curving, and slightly separating near the surface; walls thin, a little undulating; septa very thin and infrequent. Cell apertures oval, length .25 mm., width usually about one-half the length, but sometimes not more than one-third, disposed in longitudinal rows, alternating and forming oblique transverse rows at an angle of forty-five degrees to the axis of the branch, the latter arrangement being the most conspicuous. Surface between the apertures ele-

vated, angular or rounded, forming polygonal areas inclosing the cell apertures, length about .45 mm., width one-half the length. There are comparatively prominent, conical nodes at the angles of the elevations; when the frond is well preserved the elevations are rounded and strongly granulose; when a little worn or macerated they are acutely angular and the granules are minute.

This species has a general resemblance to *T.* (*O.*) *subquadrata* and *T.* (*O.*) *hexagona;* from the former it is distinguished by the stronger branches, the larger cell apertures and the larger and more elongate vestibular areas; from the latter by the somewhat larger cell apertures and vestibular areas, and by the more prominent nodes at the angles of the elevations, and the smaller granules: from *T.* (*O.*) *nexa* it is distinguished by its larger cell apertures and much stronger angular elevations between them, and their more irregular disposition.

Formation and locality. Hamilton group, West Hamburg, Erie county, N. Y.

Trematopora (Orthopora) subquadrata.

PLATE LV, FIG. 10; AND PLATE LVI, FIGS. 1, 6.

Trematopora subquadrata, Hall. Trans. Albany Institute, vol. x, p. 181. 1881.
" " " Report of State Geologist for 1883, p. 11. 1884.

Zoarium ramose, solid; bifurcations infrequent; branches widely diverging, diameter about 1.25 mm. Cells tubular, arising from the center of the branch, length a little less than 1.50 mm., for the greater portion of their length oblique, straight, curving outward near the surface, in contact for nearly their entire length, slightly separating as they approach the surface; cell walls apparently corrugated; septa very thin and infrequent. Cell apertures oval, length about .18 mm., width one-half the length, very closely and sometimes irregularly disposed, but usually in longitudinal, parallel rows, alternating and forming oblique transverse rows, having an angle of about forty-five degrees to the axis of the branch, the latter arrangement the most conspicuous. Peristomes obsolete. The narrow space between the cell apertures is elevated, sharply angular, enclosing the apertures in a rhomboidal,

or polygonal vestibular area; margins of the elevations finely granulose and at their angles are comparatively prominent nodes. The surface frequently presents a regularly reticulated appearance. In the process of growth the nodes form minute tubuli between the cell tubes.

When the surface is worn the longitudinal arrangement of the cell apertures is more clearly apparent, the nodes frequently have the appearance of quadrangular pits, and the surface of the frond seems divided into minute squares, in this condition being very unlike that of a well preserved specimen.

This species most nearly resembles *T.* (*O.*) *polygona*, but may be distinguished as follows: the cell apertures are smaller, proportionally shorter, the polygonal elevations are less elongate, more sharply angular, the granules on the margins are much more minute: from *T.* (*O.*) *hexagona* it is distinguished by its smaller, less elongate cell apertures and much narrower, angular elevations: from *T.* (*O.*) *ornata* it is distinguished by its somewhat larger cell apertures, the much narrower, more sharply angular elevations and the absence of prominent nodes, except at the angles of the elevations: from *T.* (*O.*) *reticulata* by the less regular arrangement of the cell apertures and the wider, angular elevations: from *Acanthoclema scutulatum* by the less elongate and more irregularly disposed cell apertures and the absence of very prominent nodes and pits at the base of the nodes: from *T.* (*O.*) *rhombifera* of the Lower and Upper Helderberg groups, by the broader cell apertures and the less elongate and polygonal vestibular areas.

Formation and locality. Hamilton group, Darien Centre, N. Y.

Trematopora (Orthopora) hexagona, n. sp.

PLATE LV, FIG. 8; AND PLATE LVI, FIG. 6.

This species is very similar to *T.* (*O.*) *polygona*, but the cell apertures and vestibular areas are somewhat smaller, there are no prominent nodes at the angles of the elevations between the cell apertures, and the granules on the elevations are fewer and more prominent.

Formation and locality. Hamilton group, Eighteen-mile creek, shore of Lake Erie, Erie county, N. Y.

Trematopora (Orthopora) reticulata, n. sp.

PLATE LV, FIG. 8; AND PLATE LVI, FIG. 5.

Zoarium ramose; bifurcations infrequent; branches 1 mm. in diameter. Cells tubular, arising from the center of the branch. Cell apertures oval, length .20 mm., width one-half the length, disposed in longitudinal, parallel rows, alternating and forming oblique transverse rows, the latter arrangement being the most conspicuous. Surface between the ranges of apertures elevated, angular, the elevations enclosing the cell apertures in rhomboidal, vestibular areas, and having a row of minute granules along the crests and prominent spinules at the angles.

This species in its surface characters very closely resembles *Acanthoclema scutulatum*, but the branches are somewhat larger, the cell apertures more broadly oval, and the angular elevations between them are granulose, a feature which has not been observed in that species; internally their characters are very different: from *T.* (*O.*) *subquadrata* it is distinguished by the closer and more regular disposition of the cell apertures and the more prominent nodes at the angles of the elevations, the vestibular areas are never polygonal: from *T.* (*O.*) *rhombifera* it is distinguished by the more broadly oval cell apertures and the prominent nodes at the angles of the elevations.

Formation and locality. Hamilton group, West Hamburg, Erie county, N. Y.

Trematopora (Orthopora) carinata, n. sp.

PLATE LV, FIG. 2; AND PLATE LVI, FIG. 3.

Zoarium ramose; bifurcations infrequent; branches .75 mm. in diameter. Cells tubular, arising from the centre of the branch Cell apertures oval, length .20 mm., width one-third the length, disposed in longitudinal, parallel rows, alternating and forming obliquely transverse rows, the longitudinal arrangement being the most conspicuous. Peristomes obsolete. Longitudinal ranges of apertures separated by prominent, rounded ridges, which are wider than the apertures. There is a small conical node, and occasionally two, in the transverse space between adjacent apertures.

This species very nearly resembles some of the forms of *Acanthoclema Hamiltonense*, but there are fewer ranges of apertures on a branch, the longitudinal ridges are stronger, the nodes between the cell apertures are somewhat stronger, and there are no evidences of interapertural pits: from the forms like *Acanthoclema scutulatum* having straight ridges, it may be distinguished by the stronger ridges, smaller cell apertures and nodes: from *Acantholema alternatum*, of the Upper Helderberg group, it may be distinguished by its stronger, more prominent, longitudinal ridges, and the less prominent nodes between the cell apertures: from *Trematopora* (*Orthopora*) *bi-spinulata* by the much stronger and more regular longitudinal ridges.

Formation and locality. Hamilton group, West Williams, Ontario, Canada.

Trematopora (Orthopora) tortalinea.

PLATE LVI, FIG. 9.

Trematopora tortalinea, Hall. Trans. Albany Institute, vol. x, p. 180. 1881.
" " " Report of State Geologist for 1883, p. 10. 1884.

Zoarium ramose, solid, growth usually somewhat sinuous, bifurcations infrequent; branches frequently diverging at an angle of ninety degrees, diameter from .60 to .75 mm. Cells tubular, septate, arising from the centre of the branch, abruptly curving near the surface, in contact for about two-thirds of their length. Cell apertures elongate oval, length .20 mm., width usually about one-third the length, but sometimes not more than one-fourth, disposed in longitudinal rows, which are sometimes regular and parallel, at other times somewhat irregular; apertures frequently alternating, forming oblique transverse rows; nine or ten longitudinal rows on a branch; the surface between them is elevated, forming low, rounded, sinuous or twisted ridges; the longitudinal ridges are marked by small nodes or granules, giving them a serrated appearance. The cell apertures are indistinct and frequently almost entirely obscured by the ridges. When the frond is slightly worn or macerated the longitudinal ridges are indistinct or obsolete, and the obliquely transverse disposition of the cell apertures is the most conspicuous; the frond in this condition presents a very different appearance from that of a well-preserved specimen.

This species most nearly resembles *T.* (*O.*) *lineata* of this geological formation, and *T.* (*O.*) *regularis* of the Lower and Upper Helderberg groups; the diameter of the branches is about the same, but it may be distinguished by the disposition of the cell apertures in sinuous, longitudinal rows; the ridges separating them are much less prominent than those of the other species; the whole appearance of the frond is much more irregular: when those species are worn or macerated the longitudinal disposition of the cell apertures remains the most conspicuous. From *Acanthoclema sulcatum* it is distinguished by the low, rounded ridges, the greater number of rows of apertures, and its more irregular appearance. When worn or macerated it is similar to *T.* (*O.*) *rhombifera* of the Lower and Upper Helderberg groups, but the cell apertures are surrounded by low, broad ridges, and not situated in a vestibular area as in that species; it has also a close resemblance to a macerated condition of *Acanthoclema Hamiltonense.*

Formation and locality. Hamilton group, Hamburg-on-the-Lake, Erie county, New York.

Trematopora (Orthopora) lineata, n. sp.

PLATE LV, FIGS. 3-6; AND PLATE LVI, FIG. 10.

Zoarium ramose, solid; bifurcations infrequent; branches often diverging at an angle of ninety degrees, diameter about .60 mm. Cells tubular, arising from the center of the branch, oblique to the axis, in contact for about two-thirds their length, abruptly bending outward near the surface. The arrangement of the cells is obscurely similar to Acanthoclema. Cell apertures elongate-oval, length .18 mm., width about one-third the length, distant, disposed in longitudinal, parallel rows, eight or nine rows on a branch, apertures longitudinally distant a little more than their length. Peristomes very thin, scarcely elevated. Rows separated by prominent, granulose ridges, which present a minutely serrated appearance, intermediate surface smooth. The granules on the ridges, in the course of growth, form very minute tubuli between the cells.

This species most nearly resembles *T.* (*O.*) *regularis* of the Lower and Upper Helderberg groups, but the branches are usually more slender, the cell apertures are proportionally larger and more conspicuous, and there are usually fewer ranges of apertures on a branch: from *T.* (*O.*) *tortalinea* it may be distinguished by its more rigid appearance, the more prominent and straighter longitudinal ridges; when the frond is worn or macerated the longitudinal, parallel arrangement of the cell apertures is preserved, while in that species the obliquely transverse arrangement is the most conspicuous: from *Acanthoclema sulcatum* it may be distinguished by the fewer ranges of cell apertures on a branch, by the rounded ridges separating the apertures, and the flattened surface between the ridges: from *T.* (*O.*) *carinata* it may be distinguished by its smaller size, smaller, more distant cell apertures, and the absence of nodes between the apertures: from *A. Hamiltanense* it is distinguished by its smaller size, fewer ranges of apertures on a branch, and the absence of minute pits between the cell apertures: from *T.* (*O.*) *bispinulata* by its smaller size, fewer ranges of apertures, more prominent, rigid, longitudinal ridges, and the absence of nodes between the cell apertures.

Formation and locality. Hamilton group, Darien Centre, Erie county, N. Y.

Trematopora (Orthopora) bispinulata.

PLATE LV, FIGS. 27-30; AND PLATE LVI, FIGS. 16-18.

Callopora bispinulata, Hall. Trans. Albany Institute, vol. x, p. 182. 1881.
" " " Report of State Geologist for 1883, p. 14. 1884.

Bryozoum ramose, solid; bifurcations infrequent; branches diverging at an angle of forty-five degrees, diameter from 80 to 1.25 mm., enlarging and becoming a little flattened before bifurcation. Cell apertures tubular, arising from the center of the branch, oblique to the axis for about one-half their length, and then abruptly bent toward the surface. Cell apertures oval, length about .25 mm., width from one-third to one-half the length, usually disposed in longitudinal lines, frequently alternating and forming oblique, transverse rows, sometimes somewhat irregularly disposed; distant longitudinally the diameter of an aperture. Rows of apertures separated by more

or less prominent ridges, which are sometimes straight, but usually sinuous and occasionally irregular; generally only one ridge between adjacent rows, but rarely two; when the apertures are irregularly disposed the ridges appear interrupted and involved. Peristomes very slight, scarcely perceptible. Between adjacent cell apertures there are usually two comparatively prominent, hollow, conical nodes, which, in the course of growth, form minute curved tubuli between the cells. One specimen shows indications of the longitudinal structure characteristic of the genus RHOMBOPORA.

Some specimens of this species closely resemble forms of *Acanthoclema Hamiltonense*, but the longitudinal ridges are less prominent and more irregular, and there are prominent nodes between the cell apertures in place of pits, internally it is without the filiform axis characteristic of the genus ACANTHOCLEMA. From *A. alternatum* of the Upper Helderberg group it may be distinguished by the less prominent and more irregular, longitudinal ridges, and by the smaller size and greater number of nodes: from *T.* (*O.*) *irregularis* it is distinguished by its less prominent and more irregular longitudinal ridges and the conspicuous nodes. Its general appearance is similar to *T.* (*O.*) *carinata*, but there are more ranges of apertures on a branch, the longitudinal ridges are not so rigid and prominent and are more irregular, and there are usually two nodes between adjacent apertures, there being only one in that species.

Formation and locality. Hamilton group, Moscow, Livingston county, N. Y.

TREMATOPORA (ORTHOPORA) ELONGATA, n. sp.

PLATE LV, FIG. 11; AND PLATE LVI, FIG. 15.

ZOARIUM ramose; bifurcations infrequent, sometimes distant 30 mm.; branches frequently diverging at an angle of nearly or quite ninety degrees, diameter about 1.25 mm. Cells tubular, arising from the centre of the branch, about 1.50 mm. long, oblique, straight and in contact for the greater portion of their length, abruptly bending outward near the surface, apparently without septa. Cell apertures elongate-oval, length about .25 mm., width a

little less than one-half the length; sometimes irregularly disposed, but usually in longitudinal rows, alternating and forming oblique transverse rows, the two arrangements being equally conspicuous. The peristomes are usually very slight or obsolete, the intermediate space flat or convex, the apertures appearing immersed; sometimes the peristomes are comparatively strong and the intermediate space slightly concave, the surface often presenting a confused appearance. The surface is nodose, nodes sometimes irregularly disposed, at other times there is a single row between adjacent apertures, usually surrounding the aperture, but sometimes disposed in straight lines, resembling ridges, and frequently partially obscuring the cell apertures. In the process of growth these nodes form minute tubuli between the cells. When the frond is worn or macerated the nodes are partially obliterated and the cell apertures are much more conspicuous than in a perfectly preserved specimen.

This species most nearly resembles *T.* (*O.*) *transversa*, and it will sometimes require a careful examination to distinguish them, but the branches are more slender, and the cell apertures more elongate-oval. Internally the cell tubes are not regularly curved. From *T.* (*O.*) *interplana* it may be distinguished by its more elongate-oval cell apertures and their closer disposition. From other species of this geological formation it is distinguished by its elongate cell apertures, generally surrounded by a row of comparatively prominent nodes.

Formation and localities. Hamilton group, near Canandaigua Lake, and shore of Owasco Lake, N. Y.

Trematopora (Orthopora) ornata, n. sp.

PLATE LV, FIG. 1; AND PLATE LVI, FIG. 4.

Zoarium ramose, solid; branches 1 mm. in diameter. Cells tubular, arising from the centre of the branch. Cell apertures oval, length about .20 mm., width a little less than one-half the length, disposed in longitudinal, parallel rows, alternating and forming oblique transverse rows, at an angle of forty-five degrees to the axis of the branch. Peristomes very thin, scarcely elevated. Surface between the apertures elevated, obtusely angular, and with numerous irregularly disposed nodes.

This species most nearly resembles *T.* (*O.*) *immersa*, but may be distinguished by its smaller and more closely disposed cell apertures: from *T.* (*O.*) *hexagona* it differs as follows; the cell apertures are smaller, the elevations between them are less angular, and do not have a regular row of nodes or granules along the middle; from *T.* (*O.*) *subquadrata* it is distinguished by the fewer ranges of cell apertures on a branch, their somewhat more regular disposition, the wider and less angular elevations between the cell apertures, and the more irregular disposition of the nodes on the surface.

Formation and locality. Hamilton group, Railroad station near Geneseo, N. Y.

Trematopora (Orthopora) immersa, n. sp.

PLATE LVI, FIG. 11.

Zoarium ramose; bifurcations infrequent. Cells tubular, arising from the center of the branch. Cell apertures oval, length about .20 mm., width from one-third to one-half the length, disposed in longitudinal rows, alternating and forming oblique transverse rows. Peristomes obsolete. Surface between the longitudinal rows of apertures elevated, forming prominent ridges, slightly narrower than the cell apertures; at the base of each aperture there is a comparatively prominent, conical node, and also a minute shallow pit.

This species most nearly resembles *T.* (*O.*) *carinata*, but may be distinguished as follows; the branches are somewhat larger, the ranges of apertures are more numerous, the longitudinal ridges are not so prominent and are somewhat irregular; the oblique transverse rows of apertures are much more conspicuous than in that species, the transverse space between the apertures is much less depressed: from *T.* (*O.*) *ornata* it is distinguished by its somewhat larger cell apertures, the more prominent longitudinal ridges, the fewer ranges of cell apertures on a branch, the more prominent nodes and their more regular disposition; the oblique transverse rows of apertures are much less conspicuous: from *T.* (*O.*) *bispinulata* by the stronger, more prominent, longitudinal ridges and more irregular disposition of the cell apertures

Formation and locality. Hamilton group, Darien Centre, Genesee county, N. Y.

Trematopora (Orthopora) interplana, n. sp.

PLATE LVI, FIG. 12.

Zoarium ramose; branches infrequent, diameter 1 mm. Cell apertures broadly oval, length .18 mm., width three-fourths the length, disposed in very oblique, indistinct transverse rows, separated by less than the diameter of an aperture. Peristomes very thin, slightly elevated. Surface between the apertures flat, nodose, nodes comparatively prominent, one or two series between adjacent apertures.

This species most nearly resembles *T.* (*O.*) *transversa* and *T.* (*O.*) *elongata*: from the former it is distinguished by the smaller size of the branches, and more broadly oval cell apertures: from the latter by the smaller size of the branches, the smaller, more broadly oval cell apertures, and the comparatively greater space between the apertures.

Formation and locality. Hamilton group, near Canandaigua Lake, N. Y.

Trematopora (Orthopora) granifera, n. sp.

NOT FIGURED.

Zoarium ramose; bifurcations infrequent, branches widely diverging, diameter from 1.50 to 2 mm. Cells tubular, arising from the centre of the branch, for the greater portion of their length very oblique to the axis, at about .50 mm. from the surface, abruptly bending outward, and separating from each other about the diameter of a cell tube; septa thin and infrequent. Cell apertures oval, length about .22 mm., width equal to two-thirds the length, generally irregularly disposed, but sometimes having an indistinct, oblique transverse arrangement. The surface between the cell apertures is elevated, with numerous small nodes, generally only one series, but sometimes two, between adjacent apertures. In the course of growth the nodes form minute tubuli, occupying the space between the cells near the surface. There is also a longitudinal structure, which, in a translucent section, appears as fine lines, bending abruptly downward at the cell tubes.

I have hesitated to place this species in the sub-genus ORTHOPORA on account of the irregular disposition of the cell apertures, but the internal structure, except as noted in the last sentence, is precisely the same as in undoubted species of that sub-genus.

This species most nearly resembles *T.* (*O.*) *transversa* and *T.* (*O.*) *elongata*, but it may be distinguished from both these by the irregular disposition of the cell apertures; from all other species of this geological formation it is distinguished by the numerous, comparatively prominent nodes on the elevated surface between the cell apertures.

Formation and locality. Hamilton group, Owasco Lake, N. Y.

TREMATOPORA (ORTHOPORA?) TRANSVERSA.

PLATE LV, FIG. 12; AND PLATE LVI, FIGS 13, 14

Trematopora transversa, HALL. Trans. Albany Institute, vol. x, p. 180. 1881.
" " " Report of State Geologist for 1883, p. 8. 1884.

ZOARIUM ramose, bifurcations infrequent, branches widely diverging, diameter about 1.75 mm. Cells tubular, arising from the centre of the branch, length 1.50 mm., for the greater portion of their length in contact, gently curving, and abruptly turning outward near the surface; septa near the center of the branch wanting, in the outer portion numerous, thicker than the cell walls, generally extending only partially across the cavity. Cell apertures oval, length .22 mm., width generally about one-half the length, usually disposed in longitudinal rows, frequently alternating and forming oblique transverse rows, and sometimes irregularly disposed. Peristomes moderately strong, slightly elevated. Surface between the cell apertures flat or slightly concave, with numerous small nodes or granules, one or two series around each aperture. The nodes in the course of growth form minute curved tubuli between the cell apertures.

This species most nearly resembles *T.* (*O.*) *elongata*, but may be distinguished by the thicker branches and more broadly oval cell apertures. The cell tubes are more regularly curved and the interstitial cells are more numerous, the septa are stronger, occur much more frequently and extend only partially

across the cavity: from *T.* (*O.*) *interplana* it may be distinguished by its larger branches, more elongate cell apertures, and the narrow intermediate space; from all other species of this geological formation it may be distinguished by the comparatively prominent nodes surrounding the cell apertures.

Formation and locality. Hamilton group, West Hamburg, Erie county, N. Y.

Trematopora (Orthopora?) orbipora.

PLATE LV, FIGS. 13, 14; AND PLATE LVI, FIG. 8.

Trematopora orbipora, Hall. Trans. Albany Institute, vol. x, p. 181. 1881.
" " " Report of State Geologist for 1883, p. 12. 1884.

Zoarium ramose; bifurcations infrequent; branches widely diverging. Cells tubular, arising from the center of the branch, increasing by interstitial addition, in contact for the greater portion of their length, abruptly bending outward and separating near the surface; walls very thin; septa thin, infrequent, in many of the cells entirely wanting. Cell apertures broadly oval, frequently circular, length .38 mm., width usually about three-fourths the length, but on some fronds not more than one-half, very closely and usually irregularly disposed, but occasionally forming indistinct, oblique transverse rows; the peristomes are sometimes obsolete, and the surface between the apertures is elevated, angular or rounded, with numerous minute nodes; at other times the peristomes are moderately strong and equally elevated, with minute nodes, the surface between the apertures is flat or slightly concave, and in some specimens apparently with very small pits. The nodes in the course of growth form minute tubuli between the cell tubes near the surface.

The internal characters of this form are the same as those of the species included under the sub-genus Orthopora, though some of the fronds have their cell apertures irregularly disposed, others have them regularly arranged in oblique transverse rows. I have, therefore, concluded to place it under this sub-genus, although the external characters of some of the fronds are similar to those of the sub-genus Trematella.

This species most nearly resembles *T.* (*O.*) *transversa*, but may be distinguished by the larger, more nearly circular cell apertures, their more irregular dispo-

sition, the peristomes and the absence of strong septa; from *T.* (*O.*) *elongata* it is distinguished by the size of the branches, the larger and much more broadly oval cell apertures, their more irregular and much closer disposition.

Formation and locality. Hamilton group, Fallbrook, four miles east of Canandaigua lake, N. Y.

CALLOPORA, HALL.

(See pages 21 and 75.)

CALLOTRYPA, S. G., HALL.

(See page 24.)

CALLOPORA (CALLOTRYPA) INTERNODATA.

NOT FIGURED.

Callopora internodata, HALL. Trans. Albany Institute, vol. x, p. 182. 1881.
" " " Report of State Geologist for 1883, p. 16. 1884.

ZOARIUM ramose; bifurcations frequent; branches diverging at an angle of forty-five degrees, diameter from 1 to 2 mm. Cells tubular, arising from the center of the branch. Cell apertures oval, length about .28 mm., width from one-half to two-thirds the length, closely disposed, frequently nearly or quite in contact, sometimes irregularly, and at other times regularly arranged in longitudinal and oblique transverse, parallel rows, the transverse rows being at an angle of forty degrees to the axis of the branch. Peristomes moderately strong. Inter-apertural space occupied by minute angular pits, the margins of which are elevated equally with the peristomes; there are also one or two conical nodes at each aperture, which form the most prominent feature of the surface: sometimes when the cell apertures are very closely arranged these nodes are apparently situated on the peristomes.

This species resembles *T.* (*O.*) *transversa* in having oval cell apertures, disposed in oblique transverse rows, but differs in having intermediate pits and strong, conical nodes, and by the absence of granules.

Formation and locality. Hamilton group, Darien Centre, Erie county, N. Y.

ACANTHOCLEMA, Hall. 1886.

(See page 72.)

Acanthoclema scutulatum.

PLATE LV, FIGS. 15-17; AND PLATE LVI, FIGS. 19, 20.

Trematopora scutulata, Hall. Trans. Albany Institute, vol. x, p. 180. 1881.
" " " Report of State Geologist for 1883, p. 7. 1884.

Zoarium ramose, bifurcations infrequent; branches diverging at an angle of from sixty to ninety degrees, diameter about .70 mm. Cells tubular, arising from a filiform axis at the center of the branch, in contact for the greater portion of their length, oblique to the surface and very slightly curved. Cell apertures oval, length on different fronds from .18 to .25 mm., width about .10 mm., disposed in longitudinal, parallel rows, those of adjacent rows alternating and forming oblique transverse rows, the latter arrangement being usually the most conspicuous. Peristomes very thin, slightly elevated, or entirely obsolete. The longitudinal ranges are separated by ridges, which generally unite between the cell apertures, enclosing them in a rhomboidal, vestibular area, and having at their junction a prominent, conical, hollow node. When the frond is well preserved the surface between the cell apertures is apparently solid; when slightly worn or macerated there is a crescentiform opening at the base of each aperture. There is a short tubule longitudinally between adjacent cells.

This species very closely resembles *A. alternatum*, of the Upper Helderberg group, but it is usually a little larger, the longitudinal ridges and nodes are more prominent, the ridges are nearly always sinuous and unite between the cell apertures, while in that species they are generally straight. From *Trematopora* (*Orthopora*) *reticulata* it may be distinguished by its more elongate cell apertures, the less angular and smooth longitudinal ridges; internally the structure is very different: from *T.* (*O.*) *subquadrata* it is distinguished by its much more slender branches, its more elongate-oval cell apertures and by the rhomboidal, vestibular areas From *T.* (*O.*) *rhombifera*, of the Lower and Upper Helderberg groups, it is distinguished by its more elongate-oval cell apertures

and the prominent nodes at the junction of the longitudinal ridges; from all other species, of this geological formation, by the strong, longitudinal ridges, which coalesce between the apertures, and the prominent conical nodes at the points of junction.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

Acanthoclema Hamiltonense.

PLATE LV, FIGS. 18-26.

Ceriopora? Hamiltonensis, Nicholson. Geological Magazine, April, 1874.
Callopora " Hall. Trans. Albany Institute, vol. x, p. 182. 1881.
" *bipunctata*, " Report of State Geologist for 1883, p. 15. 1881.

Zoarium ramose, solid; bifurcations infrequent; branches diverging at an angle of from fifty to ninety degrees, diameter about .75 mm. Cells tubular, arising from a filiform axis at the center of the branch, a little oblique to the surface, and slightly curved. Cell apertures oval, length .20 mm., width from one-half to two-thirds the length, usually disposed in longitudinal, parallel rows, frequently alternating and forming oblique, transverse rows; sometimes, on portions of the frond, they are somewhat irregularly disposed. Peristomes thin, scarcely elevated. The longitudinal ranges of apertures are separated by prominent ridges, which are sometimes straight, but usually slightly sinuous, frequently approaching each other between the apertures, but rarely in contact. In the transverse space between the apertures there are usually two small, usually quadrangular pits, generally situated one above the other; when the cell apertures are irregularly arranged, they are occasionally entirely surrounded by these pits; a small node also often occurs at the base of each aperture, and sometimes at each end of the aperture, obscuring the pits. These pits in the course of growth form minute, curved tubuli between the cell apertures.

This species most nearly resembles *Trematopora* (*Orthopora*) *bispinulata*, both species having the cell apertures disposed in longitudinal ranges separated by ridges, but the ridges of this species are much more prominent and regular, and the surface is marked by inter-apertural pits; the frond has also a more

delicate appearance. When well preserved this species does not resemble *A. scutulatum*, but when worn or macerated it sometimes presents a similar appearance, the inter-apertural pits being obsolete, and the ridges nearly or quite in contact between the cell apertures; but it is always without the node at the junction of the ridges, which is a characteristic feature of that species, from *A. alternatum*, of the Upper Helderberg group, it may be distinguished by its inter-apertural pits, and from *T.* (*O.*) *regularis*, of the Lower and Upper Helderberg groups, by its larger cell apertures and the presence of inter-apertural pits.

Formation and localities. Hamilton group, West Hamburg, Erie county, and near New Berlin, N. Y.

Acanthoclema sulcatum, n. sp.

PLATE LV, FIG. 7; PLATE LVI, FIG. 7.

Zoarium ramose, solid; bifurcations comparatively infrequent; branches widely diverging, diameter about .50 mm. Cells tubular, arising from a filiform axis at the center of the branch, in contact for the greater portion of their length. Cell apertures oval, length .20 mm., width about one-half their length, disposed in longitudinal parallel rows, distant more than the length of an aperture; six rows on a branch, separated by very prominent, angular, granulose ridges; the surface between the ridges is concave, giving to the cell apertures the appearance of being situated in channels. Peristomes very thin, scarcely elevated.

This species most nearly resembles *Acanthoclema triseriale* of the Upper Helderberg group, but may be distinguished as follows: the branches are somewhat more slender, the longitudinal ridges are more prominent, the cell apertures are much smaller. From *Trematopora* (*Orthopora*) *regularis* it may be distinguished by the more prominent, angular, longitudinal ridges, the comparatively larger cell apertures, and the concave surface between the longitudinal ridges; nearly the same features distinguish it from *T.* (*O.*) *tortalinea:* from *Acanthoclema alternatum* of the Upper Helderberg it is distinguished by its angular ridges and absence of nodes between the cell apertures.

Formation and locality. Hamilton group, near Canandaigua Lake, N. Y.

NEMATAXIS, HALL. 1886.

(See page 74.)

NEMATAXIS SIMPLEX.

PLATE LXVI, FIGS. 17-19.

ZOARIUM ramose, solid; bifurcations very infrequent; branches 1.50 mm. in diameter. Cells tubular, arising from the center of the branch, oblique, making a sinuous curve, in contact for the greater portion of their length, separating at a very short distance from the surface. Cell apertures oval, length about .16 mm., width two-thirds the length, disposed in parallel, longitudinal rows; sometimes alternating and forming obliquely transverse rows; separated by about one-half the length of the aperture, about eighteen rows on a branch. Peristomes very slight or entirely wanting. Surface between the apertures elevated, convex, finely granulose. In some conditions of weathering the peristomes are elevated and the surface between the cell apertures is flat.

This species is easily distinguished from *N. fibrosus* of the Upper Helderberg group, the only other species of this genus at present known, by its much smaller size. The surface has some resemblance to that of *Bactropora granistriata*, but the cell apertures are much smaller, and the space between them much narrower.

Formation and locality. Hamilton group, Darien Centre, Erie county, N. Y.

BACTROPORA, NOV. GEN.

BACTROPORA GRANISTRIATA.

PLATE LXVI, FIGS. 20-22.

Trematopora? granistriata, HALL. Trans. Albany Institute, vol. x, p. 182. 1881.
" " " Report of State Geologist for 1883, p. 13. 1884.

ZOARIUM ramose, solid; bifurcations distant; base tapering, acute at the apex, finely striated, striæ minutely granulose. Cells tubular, arising from the center of the branch, oblique, curved, walls comparatively thick; septa thin and

very infrequent. Cell apertures oval, length .25 mm., width two-thirds the length, disposed in longitudinal, sometimes twisted rows, often alternating and forming oblique transverse rows. The apertures near the basal portion of the frond are distant from each other about the width of an aperture, above this they are more closely disposed; the inter-apertural surface is flat, striated, striæ granulose. On some portions of the frond the apertures are nearly in contact, the surface between them slightly elevated, angular and granulose, inclosing the apertures in polygonal areas.

This species may be distinguished from *Nemataxis simplex* by its larger cell apertures, their less distinct arrangement in longitudinal rows, and the more prominent granulæ: from *Trematopora* (*Orthopora*) *orbipora* by the more oval apertures, more distinct arrangement in longitudinal rows and the granulose striations.

Formation and locality. Hamilton group, Darien Centre, Erie county, N. Y.

Bactropora curvata, n. sp.

PLATE LXVI, FIGS. 14-16.

The specimens observed consist of simple stipes, but it is probable that larger specimens would show a ramose character: diameter .75 mm., base obtusely pointed. Cell apertures oval, length .25 mm., width one-half the length, disposed in longitudinal parallel rows, distant the width of an aperture. Six or seven rows on a branch, separated by comparatively prominent nodose or granulose ridges; nodes small, one or two ranges on each ridge, the other portions of the surface similarly ornamented.

This species is peculiar and will be readily distinguished from any species at present known in this geological formation.

Formation and locality. Hamilton group, Canandaigua lake, N. Y.

LICHENALIA, Hall. 1852.

(See pages 30 and 77.)

Lichenalia stellata.

PLATE LVIII, FIGS. 15, 16.

Lichenalia stellata, Hall. Trans. Albany Institute, vol. x, p. 183. 1881.
" " " Report of State Geologist for 1883, p. 33. 1884.

Zoarium consisting of lamellate expansions, free or incrusting, or of masses formed by the superimposition of successive layers of growth; fronds varying in thickness from 1 to 5 mm.; under surface consisting of a thin epitheca, concentrically wrinkled, and with numerous fine, sharp, concentric striæ, and also, by rounded, somewhat obscure, radiating lines. Cells tubular, recumbent for a short distance, but for the greater portion of their length at right angles or oblique to the surface; walls thin, smooth or slightly wrinkled; septa moderately frequent. Intercellular tissue composed of vesicles; near the base these are large, irregular in size and arrangement, regularly superimposed above, forming septate inter-cellular tubuli, septa numerous, fifty or sixty in the space of 5 mm. Cell apertures oval or slightly circular, diameter .35 mm., sometimes opening directly outward, but usually a little oblique to the surface, occasionally operculated, closely disposed, radiating from the maculæ and frequently forming diagonally intersecting rows. Peristomes thick, anterior portion slightly elevated, posterior strongly elevated, oblique, smooth. Interapertural space smooth. Surface marked by prominent rounded monticules, the centres of which are distant about 6 mm., and have an elongate depression destitute of cell apertures; the cell apertures immediately adjacent to the depressions radiate therefrom, and are larger than the others, having a diameter of .50 mm. The disposition of the cell apertures in rows radiating from the central depressions give to the monticules a stellate appearance.

This species in its characteristic forms is easily recognized, but in some fronds there are variations, in which the resemblance to other species is greater: it most nearly resembles *Fistulipora operculata*, but may be distinguished

by its somewhat more numerous and prominent monticules, the more pronounced depression at the center, the closer disposition of the cell apertures, the absence of inter-apertural pits or vesicles, and the very few opercula: from *F. variapora*, to which it bears a close general resemblance, by the depression at the center of the monticules, the oblique cell apertures, and absence of mesopores: from *F. umbilicata* by the less pronounced depression at the center of the monticules, the oblique cell apertures and absence of mesopores: from *F. serrulata* and *F. confertipora* by the depression in the monticules, the oblique cell apertures and absence of mesopores.

Formation and locality. Hamilton group, West Bloomfield, N. Y.

Lichenalia subtrigona, n. sp.

NOT FIGURED.

Zoarium consisting of free or incrusting explanate fronds, or of masses formed by the accretion of successive layers of growth; under surface a thin epitheca with strong concentric wrinkles or undulations, frequently irregular or contorted, and also with fine radiating markings, caused by the recumbent portions of the cells; thickness of fronds from 1 to 5 mm. Cells tubular, rectangular to the surface, walls thin; septa moderately frequent. Intercellular tissue vesiculose, vesicles large, frequently having a diameter of between .30 and .40 mm., and rarely of more than .50 mm.; near the base they are always very irregularly disposed, and usually so for the whole depth of the frond, but sometimes more regularly superimposed above, but never having the appearance of walled, septate tubuli. Cell apertures ovate or subtrilobate, length .33 mm., width three-fourths the length, irregularily disposed, sometimes in contact, at other times separated by more than the width of an aperture. Peristomes moderately thick, usually equally elevated, but sometimes the posterior portion is the stronger, and also shows faint indications of denticulations. The surface is marked by maculæ, destitute of cell apertures, the centers of which are distant about 8 mm.; the adjacent apertures are larger than the others, more nearly circular, and have an indistinct radiation therefrom.

This species may be distinguished from *L. stellata* by the absence of prominent monticules, the nearly equally elevated peristomes, and the coarser and more irregularly disposed vesicles: from *L. vesiculata* by the more distant, more elongate, less distinctly trilobate cell apertures, and the circular, not depressed, maculæ; the maculæ of that species being elongate and depressed: from *Fistulipora trifaria* by the much less distinctly trilobate cell apertures and the absence of mesopores: from *L. substellata*, of the Upper Helderberg group, by the more elongate, more distant cell apertures, the usually more equally elevated peristomes, and the much less prominent maculæ: from *L. ramosa* by the incrusting mode of growth, elongate cell apertures, and smooth inter-apertural space: from *L. cultellata*, *L. colliculata*, and *L. cornuta* it may be easily distinguished by the absence of monticules.

Formation and locality. Hamilton group, West Williams, Ontario.

Lichenalia distans, n. sp.

NOT FIGURED.

Zoarium consisting of explanate fronds incrusting other objects, usually Cyathophylloid corals; greatest thickness observed 2 mm. Cells tubular, cylindrical, at right angles to the surface, non-septate, or septa very infrequent. Intercellular space vesiculose; vesicles near the base large and very irregularly disposed, more regularly superimposed above and sometimes, when the cells are closely disposed, appearing as septa dividing the space between the cell tubes, but never, in the specimens observed, having the appearance of walled, septate tubuli; twenty-five or thirty septa in the space of 5 mm., measured longitudinally. Cell apertures obscurely trilobate, length .40 mm., width two-thirds the length, irregularly disposed, usually distant a little more than the width of an aperture. Peristomes strong, nearly equally elevated. Inter-apertural space flat, smooth, when slightly worn or macerated occupied by shallow angular pits. Surface marked by broad, slightly elevated monticules, the centres of which are distant from each other between 6 and 7 mm., with a small, flat and smooth central area, the apertures immediately adjacent are slightly larger than the others.

This species may be distinguished by the sub-trilobate form of the apertures, their distance from each other, the nearly equally elevated peristomes and the smooth, flat, inter-apertural space.

Formation and locality. Hamilton group. Western New York; particular locality not recorded.

Lichenalia vesiculata, n. sp.

PLATE LVII, FIGS. 14-19; AND PLATE LIX, FIGS. 1, 14.

Zoarium consisting of lamellate expansions free or incrusting other objects, generally Cyathophylloid corals; no massive specimens have been observed; thickness of fronds from 1 to 3 mm.; under surface a thin epitheca with strong, concentric wrinkles, and obscure, rounded, radiating markings, caused by the recumbent portion of the cell tubes. Cells tubular, cylindrical, for nearly their entire length at right angles to the surface, septate; septa very thin, moderately frequent; cell walls finely wrinkled or corrugated. Intercellular tissue vesiculose, vesicles comparatively very large and irregularly disposed near the base, more regularly superimposed above, but in the specimens observed, never having the appearance of walled septate tubuli; width of a vesicle generally about equal to that of a cell aperture, fifteen or twenty in the space of 5 mm., measured longitudinally. Cell apertures nearly circular, having a small fold or plication in the posterior portion of the walls, which frequently gives an obscurely trilobate or triangular form, diameter .50 mm., closely disposed, often in contact, frequently forming irregular, intersecting rows. Peristomes strong, equally elevated, not denticulated, when well preserved the summits are obscurely granulose, giving them a minutely, serrulate appearance. Inter-apertural space flat, when well preserved granulose, when slightly macerated smooth. Surface marked by elongate-depressed maculæ, having a length of 5 mm., width about 1 mm., and destitute of cell apertures. The cell apertures immediately adjacent, are not larger than the others and sometimes the general direction is not altered. On some fronds the cell apertures are distinctly trilobate (Plate 59, fig. 1), but these fronds, in all other respects, agree with the ordinary forms of the species.

The elongate depressed maculæ resemble those of *L. alveata* of the Upper Helderberg group, but the species may be distinguished as follows; the cell apertures are on a plane with the surface; the peristomes are equally elevated, are not denticulated and the apertures do not distinctly radiate from the maculæ. The cell apertures, in form and size, very closely resemble those of *L. ovata* of the Upper Helderberg group, but it presents the following differences; the peristomes are equally elevated, are not denticulated, the maculæ are narrow, elongate, depressed, the apertures nearest the maculæ are not larger than the others, and sometimes do not radiate from them: from *L. substellata* it is distinguished by the narrow elongate maculæ, the obscure radiation of the apertures and equally elevated peristomes: from other species of this geological formation it is distinguished by the narrow, elongate-depressed maculæ, uniform size of apertures and non-radiation from the maculæ.

Formation and localities. Hamilton group, shore of Canandaigua lake, Ontario county; York, Livingston county, and four miles south of Le Roy, Genesee county, N. Y.

Lichenalia ramosa, n. sp.

NOT FIGURED.

Zoarium ramose, hollow, branches very frequent, diameter from 4 to 10 mm., thickness of frond from .50 to 2 mm.; the inner surface is a concentrically wrinkled epitheca. Cell tubes rectangular or oblique to the surface; septa very infrequent or entirely wanting. Intercellular space vesiculose; the vesicles are large and irregularly disposed near the base, they are smaller and more regularly superimposed above, but not having the appearance of walled, septate tubuli, from four to eight vesicles in the space of 1 mm, measured longitudinally. Cell apertures nearly circular, diameter .25 mm., irregularly disposed, generally separated by less than the diameter of an aperture and frequently in contact. Peristomes thin, scarcely elevated, and having on one side two slight denticulations. Interapertural space gently convex, granulose. Surface marked by circular, granulose maculæ, destitute of cell apertures, the centres of which are distant about 3 mm., and their

diameter a little more than 1 mm.; the apertures immediately adjacent are slightly larger than those on other portions of the frond.

This species, in its manner of growth and general appearance, is similar to *Fistulipora utriculus*, of Rominger, but the apertures are circular, while in that species they are decidedly trilobate; the manner of growth is similar to that of *Lichenalia clivulata*, of the Upper Helderberg group, but the apertures are much larger and more closely disposed, the denticulations are much less conspicuous, and the peristomes are equally elevated; the surface resembles that of *F. interaspera*, but the manner of growth is different, there is no depression at the centre of the monticules, the denticulations are much less prominent, and there are no interapertural pits: from *F. constricta* it is distinguished by its manner of growth, its less prominent monticules, the flattened or gently convex interapertural space, and the absence of mesopores; the size of the cell apertures and strength of denticulations are about the same in both species: from *F. unilinea* it is distinguished by its manner of growth, less prominent monticules, smaller and more distant cell apertures, the absence of mesopores, and the somewhat stronger denticulations: from *Lichenalia cornuta* by the manner of growth, larger and more distant cell apertures, and the much less prominent denticulations: from *Lichenalia substellata*, of the Upper Helderberg group, by the manner of growth, the thin and equally elevated peristomes, and the granulose surface.

Formation and locality. Hamilton group, West Williams, Ontario.

Lichenalia colliculata.

NOT FIGURED.

Lichenalia colliculata, Hall. Trans. Albany Institute, Vol. x, p. 184. 1881.
" " " Report of State Geologist for 1883, p. 36. 1884.

Zoarium consisting of free or incrusting lamellate expansions, or of masses formed by the accretion of successive layers of growth; epitheca strongly wrinkled concentrically, frequently contorted. Cells tubular, cylindrical, oblique or rectangular to the surface; septa thin, in some cells moderately

frequent, in others very infrequent. Intercellular tissue vesiculose, the vesicles near the base are irregularly disposed, they are regularly superimposed above, giving the appearance of walled septate tubuli, septa very numerous, almost in contact, fifteen in the space of 1 mm. Cell apertures oval, sometimes sub-quadrangular, length about .22 mm., width a little more than one-half the length, regularly and irregularly disposed, comparatively distant. Peristomes moderately thick, decidedly elevated, posterior portion a little the more prominent, smooth. When the frond is well preserved the inter-apertural space is granulose. Surface marked by prominent monticules, the centers of which are distant about 8 mm., and have a granulose area 1 50 mm. in diameter, destitute of cell apertures; the adjacent cell apertures radiate from these in straight lines, forming elevated rows and are larger than the others, gradually becoming smaller as they recede; they are more oblique than the ordinary apertures, and the upper portion of the cell wall is carinated and exposed for about .25 mm.

The radiation of the apertures on the monticules is similar to that of *Fistulipora longimacula*, but the difference in the form of the monticules and the presence of mesopores will be sufficient to distinguish that species. It most nearly resembles *Lichenalia cultellata*, but may be distinguished by the non-celluliferous central area of the monticules, the absence of the prominent ridges, radiating from the centers to the adjacent apertures, and the less distinctly trilobate form of the apertures; internally the vesicles are more numerous and have the appearance of walled, septate tubuli, which is never the case in that species: from *L. cornuta* it is distinguished by the more decidedly oval cell apertures, absence of prominent denticulations, and much more prominent monticules and peristomes: from *L. denticulata*, of the Upper Helderberg group, by its larger cell apertures, much more conspicuous monticules and the absence of prominent denticulations: from other forms having prominent monticules it may be distinguished by the small, frequently sub-quadrangular, oblique cell apertures and their radiation in straight lines from the centers of the monticules.

Formation and locality. In the shales of the Hamilton group, at York, Livingston county, N. Y.

Lichenalia cultellata.

PLATE LXIV, FIGS. 1, 2.

Lichenalia cultellata, Hall. Report of State Geologist for 1883, p. 35. 1884.

Zoarium consisting of explanate fronds, free or incrusting other objects, thickness usually about 1 mm. No masses formed by the superimposition of successive layers of growth have been observed. Cells tubular, cylindrical rectangular or oblique to the surface, non-septate, walls very thin. Intercellular space vesiculose, vesicles comparatively very large, usually irregularly disposed, sometimes more irregularly superimposed, but in the specimens observed, never appearing as walled, septate tubuli. Cell apertures trilobate or trifoliate, the posterior lobe or fold is remarkably well developed, being much larger than the other two combined, length .30 mm., width three-fourths the length, radiating from the center of the monticules, forming irregular, intersecting rows. Peristomes thin, posterior portion the more strongly elevated and with two moderately prominent denticulations. Interapertural space flat, smooth. Surface marked by strongly elevated, obtusely conical monticules, the centers of which are distant about 5 mm., irregularly disposed; on one side of the monticule, commencing at the center and extending to the base, there is a narrow, gradually enlarging depression; the apertures nearest the center are slightly larger than the others, and extending from the center of the monticules to these apertures there are sharply angular, gradually enlarging, prominent ridges; this feature gives to the cell the appearance of being so oblique that the upper portions of their walls are exposed for the entire length, but a section shows that they are only slightly oblique. In a transverse section the trilobate form of the cells is more conspicuous; the interapertural vesicles vary greatly in size and are frequently larger than the cell apertures.

The cell apertures of the specimen from which fig. 1, pl. 64, was made do not show the usual trilobate form.

The strong monticules and prominent ridges extending from their centers to the adjacent apertures are features which distinguish this species from any

other at present known, except *L. colliculata*, and it may be distinguished from that species by the somewhat larger cell apertures, greater prominence of the features above mentioned, and the larger vesicles.

Formation and localities. Hamilton group, Fall brook, four miles east of Canandaigua lake, and near York, Livingston county, N. Y.

Lichenalia cornuta, n. sp.

NOT FIGURED.

Zoarium consisting of explanate fronds, incrusting other objects, generally Cyathophylloid corals, having an observed thickness of about 1 mm. Cells tubular, septa obsolete. Intercellular tissue composed of vesicles, which are sometimes irregularly disposed, at other times regularly superimposed. Cell apertures circular or trilobate, oblique, subimbricating, diameter .30 mm., very closely disposed, radiating from the monticules and forming diagonally intersecting lines, frequently in quincunx order. Peristomes thin, slightly elevated, often scarcely perceptible, and having on one side a prominent crescentiform projection, the extremities of which are prolonged into denticulations, which in course of growth form two parallel striations along the inner surface of the cell tube. Interapertural space slightly convex and minutely granulose. Surface marked by monticules, the centers of which are distant between 4 and 5 mm., arranged in sub-regular intersecting rows; the center of the monticules are convex, minutely granulose, and destitute of cell apertures for the space of 1.50 mm., the apertures immediately adjacent are sometimes very slightly larger than those on other portions of the frond. When the frond is worn or macerated, the interapertural space is flattened, the granules are obsolete, leaving very minute, angular pits in their place; in this condition it has but a slight resemblance to a perfectly preserved frond.

This species may be distinguished from *Fistulipora constricta* by the smaller cell apertures, more prominent denticulations, and the granulose inter-apertural space; from *F. ramosa* by the manner of growth, being incrusting only, the

smaller cell apertures, their trilobate form and the more prominent denticulations, the resemblance however is frequently very close: from other species it is distinguished by the small apertures, prominent denticulations and convex, granulose, inter-apertural surface.

Formation and localities. Hamilton group, near York, Livingston county, and four miles south of Le Roy, Genesee county, N. Y.

Lichenalia confusa, n. sp.

NOT FIGURED.

Zoarium consisting of thin explanate fronds incrusting other objects, usually Cyathophylloid corals; greatest thickness less than 1 mm., though fronds of nearly 90 mm. in diameter have been examined. Cells tubular, cylindrical. Intercellular space vesiculose, vesicles irregularly disposed. Cell apertures circular, broadly oval or sub-triangular, diameter .33 mm., very closely and usually irregularly disposed, generally in contact and sub-imbricating. Peristomes moderately thick, the posterior portion the more strongly elevated; the peristomes of adjacent apertures are frequently in contact and coalesce, the frond then presenting a regularly reticulate appearance; and when in contact, but not coalescing, the frond often presents a festooned appearance; when the peristomes are not in contact, a condition seldom occurring, the inter-apertural space is smooth. Surface marked by slightly elevated, closely disposed monticules, the apertures nearest their centers radiate from them, are less closely disposed, slightly larger and more oblique than the others.

This species will be easily distinguished from the others by the crowded cell apertures, and the festooned or reticulate appearance of the surface of the frond.

Formation and locality. Hamilton group, four miles south of Le Roy, Genesee county, N. Y.

Lichenalia bullata, n. sp.

PLATE LVII, FIGS. 12, 13.

Zoarium consisting of free or incrusting explanate fronds. Cell apertures circular or oval, diameter .50 mm. Peristomes moderately thick, the posterior portion the more strongly elevated, a little oblique. Inter-apertural space occupied by vesicles nearly equal in diameter to the cell apertures. Sometimes on portions of a frond the vesicles are much enlarged and the cell apertures correspondingly small.

Formation and locality. Hamilton group, four miles south of Le Roy, Genesee county, N. Y.

Lichenalia operculata, n. sp.

NOT FIGURED.

Zoarium consisting of free or incrusting lamellate expansions, or of masses, formed by the superimposition of successive layers of growth; thickness of fronds from .50 to 5 mm. Cells tubular, cylindrical, rectangular or slightly oblique to the surface; septa thin, moderately frequent. The intercellular space is vesiculose; near the base the vesicles are large and very irregularly disposed; they are smaller and regularly superimposed above, frequently having the appearance of walled septate tubuli, with from twenty-five to forty septa in the space of 5 mm. Cell apertures circular, often pustuliform, oblique to the surface, diameter .40 mm., radiating from the centers of the monticules, generally forming closely disposed, diagonally intersecting rows, frequently in contact, usually operculated; the opercula are conspicuous, consisting of thin, slightly convex plates, extending entirely across the cell apertures. Peristomes thick, sometimes equally elevated, but usually the posterior portion is the more prominent, oblique, longitudinally striated. Inter-apertural space occupied by bullæ, which are marked by short, broad, interrupted striations; when the frond becomes slightly worn these bullæ are broken away, leaving the appearance of shallow angular pits. Surface marked by broad, rounded monticules, the centers of which are distant from

each other about 6 mm., the bases nearly in contact; there is an elongate, non-celluliferous space at the center occupied by bullæ, the cells immediately adjacent being slightly larger than the others and much more oblique.

This species in general appearance approaches very nearly to *L. stellata*, but may be distinguished by the less prominent monticules, the absence of a pronounced central depression, the operculated cell apertures, and the striato-bullate inter-apertural surface: in its conspicuous opercula it resembles *Fistulipora serrulata*, but may easily be distinguished by its larger and more oblique cell apertures, the larger apertures on the monticules and the absence of mesopores: nearly the same features distinguish it from *F. umbilicata*, *F. variopora* and *F. confertipora*.

Formation and localities. Hamilton group, York, Livingston county, and four miles south of Le Roy, Genesee county, N. Y.

Lichenalia pustulosa, n. sp.

NOT FIGURED.

Zoarium consisting of free or incrusting explanate fronds, or of masses formed by the superimposition of successive layers of growth; thickness of fronds observed from 2 to 5 mm. Under surface consisting of an epitheca with strong, concentric wrinkles and undulations, and fine radiating markings, caused by the recumbent portion of the cells. Cells tubular, rectangular or slightly oblique to the surface, walls strong, smooth; septa very thin, in some of the cells moderately frequent, in others obsolete. Intercellular tissue vesiculose, the vesicles near the base are very irregularly disposed, more regularly disposed above, having the appearance of septa, transversely dividing the intercellular space, or of walled septate tubuli; septa very closely disposed, from sixty to ninety in the space of 5 mm. Cell apertures circular, diameter about .25 mm., irregularly disposed, sometimes in contact, and seldom distant more than one-half the diameter of an aperture. The apertures are generally operculated, the opercula consisting of convex or subconical plates extending entirely across the apertures; sometimes they are convex, with a comparatively prominent node at the center. Peristomes

moderately thick, sub-equally elevated, and having on one side two denticulations. Inter-apertural space flat, smooth or with indications of the vesicles below. Surface marked by prominent, conical monticules, the centers of which are distant about 7 mm., and have cell apertures larger than the others, more oblique and pustuliform, often presenting a confused appearance. When the frond is worn or macerated the surface presents a much different aspect from that of well preserved specimens; the cell apertures are obscurely trilobate; the peristomes are strong and equally elevated; the inter-apertural space is occupied by minute angular pits, the margins of which are elevated a little less than the peristomes.

In having conspicuous opercula this species resembles *L. operculata* and *Fistulipora serrulata;* from the former it may be distinguished by the more prominent and more frequent monticules, the equally elevated peristomes, the absence of bullæ on the inter-apertural surface, and the prominent apertures at the center of the monticules; in that species there is a circular space destitute of cell apertures: from *F. serrulata* it may be distinguished by the more prominent monticules, more closely disposed cell apertures, the presence of denticulations and the absence of mesopores; in the pustuliform apertures at the center of the monticules it resembles *L. conulata* of the Upper Helderberg group, but the mode of growth is different, the monticules are much larger and more distant, and the ordinary cell apertures are not pustuliform: from the other species, at present known, it may be distinguished by its conspicuous opercula and the prominent pustuliform cell apertures of the monticules.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

Lichenalia tessellata, n. sp.

NOT FIGURED.

Zoarium consisting of flattened expansions or of masses formed by the accretion of successive layers of growth; fronds observed from 2 to 5 mm. in thickness; epitheca very thin and, on the specimens examined, not strongly wrinkled concentrically, as in nearly all other species. Cells tubular, apparently polygonal, generally rectangular to the surface, walls thin,

strongly and regularly corrugated; corrugations sharp, five in the space of 1 mm. Septa extremely thin, in some cells moderately frequent, in others obsolete. Intercellular tissue vesiculose; the vesicles near the base are large and very irregularly disposed, they are smaller above and more regularly superimposed, frequently having the appearance of septate tubuli, with strongly corrugated walls. A transverse section shows the cells to be cylindrical, frequently partially in contact and the ordinary cells never distant more than .10 mm. Cell apertures circular, diameter .30 mm., very closely and usually irregularly disposed, but sometimes forming sub-regular curved lines on the monticules, generally distant a little more than one-fourth the diameter of an aperture. Peristomes usually obsolete. Inter-apertural space elevated, angular, sometimes with minute nodes at the angles, giving to the apertures a polygonal appearance, much resembling those of some form of FAVOSITES. Surface marked by broad, convex monticules, the centers of which are distant from 5 to 8 mm., and have a granulose circular area, about 1.75 mm. in diameter, destitute of cell apertures. The apertures immediately adjacent are a little larger and more distant than the others, a little oblique and with very thin peristomes, the posterior portions of which are the stronger, with evidences of very slight denticulations; the space between these apertures is somewhat flattened and sometimes with a very slender striation.

This species may be distinguished from *Fistulipora constricta* by the broader, more distant monticules, the larger cell apertures, destitute of peristomes and denticulations, the smooth interapertural space and the absence of mesopores: from *F. unilinea* it is distinguished by the more prominent monticules, the absence of peristomes and denticulations and the angulated inter-apertural space without mesopores; nearly the same features will distinguish it from *F. interaspera*. From any other species at present known, in the Lower and Upper Helderberg and Hamilton groups, it may be distinguished by the circular, closely disposed cell apertures without peristomes or denticulations, and the smooth angular, inter-apertural space, giving to the apertures an appearance similar to those of some forms of FAVOSITES.

Formation and locality. Hamilton group, Genesee Valley, N. Y.

FISTULIPORA, McCoy. 1849.

(See pages 27, 87.)

Fistulipora longimacula.

NOT FIGURED.

Thallostigma longimacula, Hall. Trans. Albany Institute, vol. x, p. 185. 1881.
" " " Report of State Geologist for 1883, p. 23. 1884.

Zoarium consisting of lamellate expansions, incrusting other objects, thickness from .50 to 1.50 mm.; no masses formed by the accretion of successive layers of growth, have been observed. Cells tubular, round or sub-angular, oblique or rectangular to the surface; septa infrequent or entirely wanting. Intercellular space vesiculose; near the base the vesicles are irregularly disposed, and more regularly superimposed above, giving the appearance of septate tubuli; septa numerous, fifteen or twenty in the space of 5 mm. Cell apertures oval or trilobate, frequently sub-quadrangular, length a little more than .20 mm., width about two-thirds the length, regularly and irregularly disposed, comparatively distant. Peristomes thin, sometimes equally elevated, at other times the posterior portion is the more strongly elevated and has occasionally two slight denticulations. Mesopores variable in size, frequently larger than the cell apertures; margins slightly elevated, smooth. Surface marked by low, elongate monticules, at the middle of each there being a comparatively deep depression, having a length of between 3 and 4 mm., and a width of little less than 1 mm., destitute of cell apertures and occupied by mesopores; the adjacent apertures are larger than the others and radiate from the depressions in straight lines, forming elevated rows, gradually growing smaller as they recede. The cell apertures on the other portions of the frond are irregularly disposed.

The cell apertures in size and shape resemble those of *Lichenalia cultellata*, but this species will be easily distinguished from that one by the elongate monticules with depressed centers, and the presence of mesopores; these features will distinguish it from any other species at present known, from this geological formation.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

Fistulipora variapora.

PLATE LVIII, FIGS. 9-14.

Thallostigma variapora, Hall. Trans. Albany Institute, vol. x, p. 184. 1881.
" " " Report of State Geologist for 1883, p. 18. 1884.

Zoarium consisting of explanate, free or incrusting fronds, or of masses formed by the superimposition of successive layers of growth; fronds from 1 to 15 mm. or more in thickness; the under side consists of a thin, strongly wrinkled epitheca, from which the cells arise rectangularly to the surface. Cells tubular, cylindrical, septate; septa thin, occurring at irregular, usually somewhat distant intervals. Intercellular tissue composed of vesicles, which, near the base, are irregular, becoming more regularly disposed above, and having the appearance of septate tubuli; septa very frequent, about sixty in the space of 5 mm. Cell apertures circular, obscurely triangular or trilobate, diameter .35 mm., irregulary disposed, sometimes in contact, usually distant about one-half the diameter of an aperture, frequently operculated; opercula smooth, solid and slightly convex at the center, with several radii extending to the peristome. Peristomes strong, equally elevated, when perfectly preserved having two minute denticulations. Mesopores obscure; margins slightly elevated, diameter usually about one-half that of the cell aperture. The surface is marked by broad, rounded monticules, the centers of which are distant from each other about 5 mm., the bases nearly or quite in contact; a central space of 1 mm. in diameter is occupied by mesopores, which are smaller than those on other portions of the frond; the cell apertures immediately adjacent are larger than the others, having a diameter of .50 mm., from twelve to fifteen of the larger cells on each monticule.

This species most nearly resembles *F. umbilicata*, but the centers of the monticules are very slightly, if at all depressed, the space destitute of cell apertures is much smaller, and the apertures are a little larger, more distinctly trilobate and more closely disposed: from *Lichenalia stellata* it is distinguished by the absence of a pronounced depression at the centers of the monticules, by the equally elevated peristomes and the presence of mesopores: from *F. con-*

fertipora by the more prominent and distant monticules, the larger and more distant sub-trilobate cell apertures, the stronger peristomes, the absence of nodes on the peristomes, and the comparatively indistinct mesopores: from *F. serrulata* by the larger cell apertures, their form and closer disposition, the much greater variation in the size of the apertures and the absence of serrulations on the peristomes.

Formation and localities. Hamilton group, West Williams, Ontario, Canada; shore of Canandaigua lake, and York, Livingston county, N. Y.

FISTULIPORA CONFERTIPORA.

PLATE LVIII, FIGS. 1-5.

Thallostigma confertipora, HALL. Trans. Albany Institute, vol. x, p. 184. 1881.
" " " Report of State Geologist for 1883, p. 19. 1884.

ZOARIUM consisting of explanate, free or incrusting fronds, or of masses formed by the superimposition of successive layers of growth; fronds varying from .50 to 5 mm. in thickness; the under surface consists of a thin, strongly wrinkled epitheca, from which the cells arise, obliquely for a short distance, but for nearly their entire length are rectangular to the surface; cells tubular, cylindrical, septate, transverse section circular; septa thin, occurring at irregular intervals, infrequent; cell walls thin, with numerous fine corrugations which frequently resemble nodes, about six in the space of 1 mm. Intercellular tissue composed of vesicles which are irregularly disposed near the base, becoming more regular above, having the appearance of narrow septate tubuli, from fifty to sixty septa in the space of 5 mm. Cell apertures circular, diameter .30 mm., closely and irregularly disposed, very frequently in contact. Peristomes moderately strong, distinctly and equally elevated, when well preserved having several short spines, which sometimes form the most conspicuous feature of the surface. Mesopores minute, usually only a single series between adjacent apertures; margins elevated slightly less than the peristomes. The surface is marked by low, rounded monticules, the centers of which are distant from each other about 4 mm., disposed in diagonally intersecting rows with their bases in contact. The cell apertures on the

monticules extend to the center and are not larger than those on other portions of the frond.

The cell apertures and mesopores of this species are very similar to *F. ponderosa* of the Lower Helderberg group, but it may be distinguished by the numerous monticules and the regular disposition of the vesicles, forming septate tubuli; the surface of that species is without monticules or maculæ, the vesicles are irregularly disposed, and the spines on the peristomes are stronger: from *F. variapora* it is distinguished by the more numerous monticules, the smaller and more nearly circular cell apertures, their closer disposition, their uniform size and the absence of a non-celluliferous space at the center of the monticules: from *F. serrulata*, by the more numerous monticules, the much closer disposition of the cell apertures and the minute mesopores: from *F. scrobiculata* by the prominent monticules, the closer disposition of the cell apertures and the minute mesopores.

Formation and locality. Hamilton group, Moscow, Livingston county, N. Y.

Fistulipora scrobiculata.

PLATE LVIII, FIGS. 17, 18.

Thallostigma scrobiculata, Hall. Trans. Albany Institute, vol. x, p. 184. 1881.
" " " Report of State Geologist for 1883, p. 20. 1884.

Zoarium consisting of explanate, free or incrusting fronds, or of masses formed by the superimposition of successive layers of growth; the fronds observed vary from .50 to 2 mm. in thickness; the under surface consists of an epitheca, strongly wrinkled concentrically, and showing radiating markings, caused by the recumbent portion of the cell tubes. Cells tubular, for a short distance nearly parallel with the epitheca, but for nearly their entire length rectangular, or slightly oblique to the surface, invariably opening directly outward, walls thin, smooth; septa infrequent. Intercellular space vesiculose; near the base the vesicles are irregularly disposed, more regularly above, having the appearance of septa dividing the space between the cell apertures, and occurring at irregular intervals, sometimes four or five in the space of 1 mm, at other times only one or two. Cell apertures circular,

diameter about .25 mm., irregularly disposed, generally distant from each other a little more than their diameter. Peristomes strong, equally elevated, granulose when well preserved. Mesopores large, frequently equal in size to the cell apertures; margins elevated slightly less than the peristomes. Surface marked by sterile maculæ of 1 to 2 mm in diameter, occurring at irregular intervals, the cell apertures immediately adjacent not larger than the others.

The characteristics of this species are the absence of monticules and the comparatively distant cell apertures. It may be distinguished from *F. serrulata* which it resembles in size and frequency of the cell apertures, by the absence of monticules and conspicuous opercula: from *F. variapora* and *F. confertipora* by the absence of monticules and by its large mesopores.

Formation and localities. Hamilton group, Eighteen-Mile creek, Erie county, and Bellona, Yates county, N. Y.

Fistulipora umbilicata.

NOT FIGURED.

Thallostigma umbilicata, Hall. Trans. Albany Institute, vol. x, p. 185. 1881.
" " " Report of State Geologist for 1883, p. 22. 1884.

Zoarium consisting of free or incrusting lamellate expansions, or of masses formed by the superimposition of successive layers of growth; greatest thickness of the fronds observed 1.50 mm.; under surface consisting of an epitheca with strong concentric wrinkles. Cells tubular, cylindrical, rectangular or slightly oblique to the surface, usually opening directly outward. Intercellular space vesiculose; near the base the vesicles are irregularly disposed, above they are regularly superimposed. Cell apertures circular, diameter about .30 mm., irregularly disposed, usually distant about three-fourths the diameter of an aperture. Peristomes strong, equally elevated, smooth. Mesopores variable in size, sometimes minute, at other times nearly as large as the cell apertures; margins slightly elevated, sometimes continuing upon the peristomes and giving them a strongly striated appearance. Surface marked by broad, rounded monticules, the centers of

which are distant from each other from 5 to 6 mm., very much depressed and destitute of cell apertures; the apertures immediately adjacent to the depressed portion are larger and much more oblique than on other parts of the frond.

The surface varies in appearance according to the degree of preservation; when weathered the peristomes are stronger and more elevated, and the mesopores more conspicuous than when the frond is perfectly preserved; in the latter case the intermediate pits are very obscure.

This species may be distinguished from *F. variapora* by the circular, slightly smaller and more distant cell apertures, the depressed centers of the monticules, the larger mesopores, and the more irregular vesicular structure; in the latter species they have the appearance of septate tubuli: from *Lichenalia stellata* by the deeper depression at the centers of the monticules, the smaller and more distant cell apertures, the equally elevated peristomes, the presence of mesopores, and the more irregular arrangement of the vesicles: from *F. serrulata* by the depression in the monticules, the larger and more oblique cells near their centers, the closer disposition of the apertures, and the absence of serrulations on the peristomes.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

Fistulipora serrulata.

PLATE LVIII, FIGS. 6–8.

Thallostigma serrulata, Hall. Trans. Albany Institute, vol. x, p. 185. 1881.
" " " Report of State Geologist for 1883, p. 20. 1884.

Zoarium consisting of free or incrusting explanate fronds, or forming masses composed of successive layers of growth. Cells tubular, cylindrical, septate, rectangular or slightly oblique to the surface, invariably opening directly outward; septa very infrequent or obsolete; cell walls comparatively thick, longitudinally striated. Intercellular tissue composed of vesicles, which are sometimes very irregularly, at other times regularly disposed, but not having the appearance of tubuli divided by septa as in many species, but of vesicles superimposed in somewhat regular order.

Cell apertures circular, diameter .30 mm., irregularly disposed, usually distant from each other about the diameter of an aperture; apertures usually operculate, the opercula rounded or conical at the centers, with five or six ridges radiating from the center to the peristomes. Peristomes strong, equally elevated, the striations of the cell walls extending over their margins and giving them a serrulate appearance. Mesopores large, their diameter being frequently more than that of the cell apertures; margins slightly elevated, and when well preserved granulose.

Surface marked by low, rounded maculæ, the centers of which are distant about 6 mm., having a small area occupied by mesopores; the apertures immediately adjacent are a little larger than the others, but the difference in size is not conspicuous.

The characteristic features of this species are the opercula, which are well preserved in all the specimens seen; the same feature is also conspicuous in *F. operculata*, but this species may be readily distinguished by the smaller size of the cell apertures, the equally elevated peristomes, the difference in the character of the opercula, and by the mesopores, that species having vesicles between the cell apertures: from *F. confertipora* it is distinguished by its larger, more distant monticules, the more distant cell apertures, the minute serration of the peristomes, and the much larger mesopores: from *F. variapora* by the more distant cell apertures, their more nearly uniform size, and the larger mesopores: from *F. scrobiculata* by the prominent monticules, that species having maculæ not elevated above the surface; the mesopores and cell apertures are very similar in appearance, except that the opercula are rarely present in the cells of the latter species.

Formation and locality. Hamilton group, West Bloomfield, N. Y.

Fistulipora plana.

PLATE LVIII, FIGS. 19, 22.

Thallostigma plana, Hall. Trans. Albany Institute, vol. x, p. 187. 1881.
" " " Report of State Geologist for 1883, p. 30. 1884.

Zoarium consisting of thin lamellate expansions, incrusting or free, thickness less than 1 mm. No masses formed by the accretion of successive layers of

growth have been observed. Cells tubular, cylindrical, opening directly outward. Intercellular tissue vesiculose; vesicles sometimes irregularly disposed, at other times apparently forming septate tubuli. Cell apertures circular, diameter about .33 mm.; on some fronds regularly distant from each other a little less than their diameter, on others irregularly disposed, distance varying from contact to twice their diameter. Peristomes thick, equally and strongly elevated, the apertures being very prominent. Mesopores obscure, variable in size, frequently nearly as large as the cell apertures; margins very slightly elevated, sometimes obsolete, the surface being smooth; when the surface is worn or much weathered they are more prominent. Surface marked by circular or elongate, depressed maculæ, destitute of cell apertures, the adjacent apertures being a little larger than those on other portions of the frond.

This species most nearly resembles *F. serrulata* in the size and prominence of the cell apertures, but may be distinguished by their greater distance, the absence of striations on the cell walls, and of granules on the peristomes and margins of mesopores, and the flattened maculæ; from *F. scrobiculata* by the stronger peristomes, much more prominent cell apertures, and much more obscure mesopores. The depressed maculæ will distinguish it from all the forms having monticules: from *F. segregata* it is distinguished by the larger cell apertures, the much larger, but less conspicuous, mesopores: from *Lichenalia substellata*, of the Upper Helderberg group, by the more prominent apertures, equally elevated peristomes, and absence of conspicuous maculæ or monticules: from *L. permarginata*, which in some respects it closely resembles, by the less conspicuous maculæ, non-radiation of the cell apertures from them, and by the presence of mesopores.

Formation and locality. Shales of the Hamilton group, Darien Centre, N. Y.

Fistulipora unilinea, n. sp.

PLATE LVII, FIGS. 1, 2, 5.

Zoarium sometimes consisting of thin lamellate expansions, incrusting Cyathophylloid corals or other objects, but very frequently forming hemispherical or spheroidal masses by the superimposition of successive layers of growth. Cells tubular, cylindrical, rectangular to the surface; septa wanting. Intercellular space vesiculose, vesicles near the base large, irregularly disposed, more regularly superimposed above, but never having the appearance of septate tubuli. When the vesicles are regularly superimposed there are about forty in the space of 5 mm. Cell apertures circular, diameter .33 mm., very closely and irregularly disposed; on different fronds and under different conditions they vary greatly in appearance; usually the peristomes are thin, equally elevated, and the apertures surrounded by one series of mesopores; on other fronds the peristomes are more decidedly elevated and the apertures are a little more distant. Sometimes there is an oblique projection or slight denticulation on the posterior portion of the peristome; at other times, on portions of a frond, the peristomes are thickened, coalescing with those of adjacent apertures, obliterating the mesopores, which in this condition resemble the polygonal cell apertures of a Chætetes. When the frond is well preserved there are frequent spinules on the peristomes. Mesopores minute, usually only one series between adjacent apertures; margins elevated a little less than the peristomes, granulose, the granules very frequently obscuring the mesopores. Surface marked by very slightly elevated monticules, the centers of which are usually distant about 6 or 7 mm., with a space 1.50 or 2 mm. in diameter, destitute of cell apertures and occupied only by mesopores, which are obscured by the prominent granules on their margins; the adjacent cell apertures radiate from the sterile areas and are larger than the others, having a diameter of .50 mm.

This species most nearly resembles *F. spheroidea*, but may be distinguished by the smaller cell apertures, the granulæ on the margins of the mesopores, and the presence of monticules: from *F. constricta* it is distinguished by the some-

what larger cell apertures, the more elevated mesopores, the more prominent monticules, and the greater central space, destitute of cell apertures.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

Fistulipora interaspera, n. sp.

NOT FIGURED.

Zoarium consisting of explanate fronds incrusting other objects, usually Cyathophylloid corals; no masses formed by the superimposition of successive layers of growth have been seen; thickness of observed fronds from .50 to 1 mm. Cells tubular, cylindrical, rectangular to the surface; septa frequent. Intercellular space vesiculose, vesicles near the base large, irregularly disposed, a little smaller and more regularly superimposed above. Cell apertures trilobate, length about .25 mm., width usually about two-thirds the length, but sometimes equalling it, radiating from the maculæ, forming irregular, intersecting rows, which are usually distant about the diameter of an aperture. Peristomes moderately thick, posterior portion the more strongly elevated, with two slight denticulations, which, in the course of growth, form two parallel ridges along the interior of the cell wall. Inter-apertural space flat, occupied by small angular pits, with comparatively prominent nodes at the angles; the nodes often almost entirely obscure the mesopores, the interapertural surface appearing solid, granulose, and the frond in this condition apparently belongs to the genus Lichenalia. Surface marked by low, rounded, irregularly disposed monticules, the centers of which are distant from each other about 5 mm.; a depressed central space of 1.50 or 2 mm. in diameter, destitute of cell apertures and occupied by the minutely nodose mesopores.

This species has a close resemblance to *F. constricta*, but may be distinguished from that species by the more distant cell apertures, much more prominent peristomes, more decidedly trilobate apertures, and the flat interapertural surface; it most nearly resembles *F. unilinea*, but it may be distinguished by the somewhat smaller, more elongate and decidedly trilobate cell apertures,

the greater space between them, and the more prominent projection from the posterior portion of the peristome: it may be distinguished from *F. confertipora* by the trilobate cell apertures, the denticulations and the more prominent and distant monticules: from *F. spheroidea* by the manner of growth, the smaller cell apertures, their trilobate form, and denticulations: from *L. vesiculata* by the prominent monticules, the less frequent cell apertures, and the nodose or granulose mesopores.

Formation and locality. Hamilton group, on the shore of Canandaigua lake, Ontario county, New York.

Fistulipora segregata.

PLATE LIX, FIG. 4.

Thallostigma segregata, Hall. Trans. Albany Institute, vol. x, p. 186. 1881.
" " " Report of State Geologist for 1883, p. 27. 1884.

Zoarium forming thin lamellate expansions, free or incrusting other objects; the fronds having an observed thickness of .50 mm.; under surface a thin, wrinkled epitheca. Cells tubular, cylindrical, gradually increasing in size to the aperture, arising obliquely from the epitheca, curving and opening directly outward. Cell apertures broadly oval or circular, length .25 mm., irregularly disposed, generally separated by a space equal to or greater than the diameter of an aperture. Peristomes strong, distinctly and equally elevated, smooth on the specimens observed. Mesopores comparatively large, generally two, but frequently three series between adjacent apertures; margins elevated slightly less than the peristomes. Surface marked by low, rounded monticules, the centers of which are destitute of cell apertures, and are distant from each other about 3 mm.; the apertures on the monticules are not larger than those on other portions of the frond.

This species has a general resemblance to *F. micropora*, but the cell apertures are larger, more nearly circular and more distant from each other, and the mesopores are larger: from *F. multaculeata* it is distinguished by the more broadly oval, nearly circular and more distant cell apertures, larger mesopores and absence of spinules on the peristomes and margins of apertures: from *F. decipiens* by the more broadly oval cell apertures, their greater distinctness, and the smaller

mesopores; in that species the cell apertures are sometimes polygonal, and it is frequently difficult to distinguish the apertures from the mesopores: from *F. confertipora* by the smaller and more distant cell apertures: from *F. tegens* by the larger cell apertures and mesopores: from *F. minuta* by the more distant cell apertures and their more irregular disposition: on that species they are generally so arranged that the peristomes and margins of the mesopores give a striated appearance to the surface of the frond: from *F. digitata* by the larger and more distant cell apertures, the larger mesopores, and the absence of comparatively strong nodes between the cell apertures: from *F. densa* by the larger and more distant cell apertures, and the absence of maculæ composed of larger cell apertures: from *F. intercellata*, of the Upper Helderberg group, by its more nearly circular and more distant cell apertures, thinner peristomes and larger mesopores.

Formation and locality. Hamilton group, Eighteen-Mile creek, Erie county, New York.

Fistulipora micropora.

PLATE LVII, FIG. 20; AND PLATE LIX, FIG. 3.

Thallostigma micropora, Hall. Trans. Albany Institue, vol. x, p. 186. 1881.
" " " Report of State Geologist for 1883, p. 26. 1884.

Zoarium consisting of very thin lamellate expansions, incrusting other objects, especially crinoid columns; greatest thickness observed .33 mm. Intercellular tissue vesiculose. Cell apertures broadly oval, frequently nearly circular, length about .18 mm. or less; irregularly disposed, varying from contact to a space equal to the width of an aperture. Peristomes thin, equally elevated, and smooth on the specimens observed. Mesopores minute, about ten in the space of 1 mm., generally only one series between adjacent apertures, rarely two; margins of the same height as the peristomes.

This species may be distinguished from *F. segregata* by the thinner fronds, the smaller cell apertures, their closer arrangement, and the more delicate appearance of the surface of the frond: from *F. digitata* by the different manner of growth, the smaller cell apertures, their less frequent occurrence,

and the absence of comparatively strong conical nodes between the cell apertures: from *F. multaculeata* by the more delicate appearance of the surface of the frond, the smaller and more broadly oval cell apertures, and the absence of minute spines on the peristomes and at the angles of the margins of the mesopores: from *F. minuta* by the smaller cell apertures, the much smaller mesopores, and the difference in the arrangement of the cell apertures, which, in that species, are disposed so as to give a striated appearance to the surface: from *F. intercellata*, of the Upper Helderberg group, by the finer appearance of the surface of the frond, the smaller cell apertures, and the much thinner walled mesopores; in manner of growth, habit and general appearance it most nearly resembles *F. tegens* of this geological formation, but the cell apertures are slightly larger and more oval, the mesopores are larger, and generally only one series between adjacent apertures, while in that species there are usually two and sometimes three series: from *F. densa* it is distinguished by the smaller and more distant cell apertures, and the absence of maculæ composed of larger apertures: from *F. decipiens* by the smaller, more regularly oval cell apertures, and the much smaller mesopores.

Formation and locality. Hamilton group, Eighteen-Mile creek, Erie county, New York.

Fistulipora involvens, n. sp.

PLATE LIX, FIG. 2.

Zoarium consisting of thin foliaceous expansions, incrusting other objects; greatest observed thickness less than .50 mm. Cell apertures nearly circular or broadly oval, diameter about .15 mm., irregularly disposed, usually separated by more than the diameter of an aperture. Peristomes thin, not elevated above the surrounding surface, the apertures frequently appearing immersed. Mesopores very minute, from two to four ranges between adjacent apertures; margins equal to or higher than the peristomes.

This species most nearly resembles *F. micropora*, but may be distinguished by the more nearly circular cell apertures, their wider separation, the more minute mesopores, and the greater number of series between adjacent cell

apertures; from all other species, at present known in this formation, it is distinguished by its smaller cell apertures and extremely minute mesopores.

Formation and locality. Shales of the Hamilton group, two and a half miles east of Alden station, Erie county, N. Y.

Fistulipora trifaria, n. sp.

NOT FIGURED.

Zoarium consisting of free or incrusting explanate fronds; greatest observed thickness about 1 mm. Cells tubular, cylindrical, rectangular to the surface; septa very thin and infrequent. Intercellular space vesiculose; near the base the vesicles are large and very irregularly disposed; they are somewhat more regularly superimposed above, but never having the appearance of septate tubuli in the specimens observed. Cell apertures trilobate, length about .30 mm., width slightly less, irregularly disposed, sometimes in contact, at other times distant the diameter of an aperture or even more. Peristomes thin, equally elevated, apparently not denticulated, sometimes having minute nodules or spinules. Mesopores variable in size, frequently nearly as large as the cell apertures. Surface marked by elongate, slightly depressed maculæ, disposed at irregular intervals.

The cell apertures of this species most nearly resemble those of *Lichenalia vesiculata*, but it is easily distinguished by the presence of mesopores.

Formation and locality. Hamilton group, Fallbrook, four miles east of Canandaigua lake, N. Y.

Fistulipora triangularis.

NOT FIGURED.

Thallostigma triangularis, Hall. Trans. Albany Institute, vol. x, p. 187. 1881.
" " " Report of State Geologist for 1883, p. 32. 1884.

Zoarium consisting of free or incrusting lamellate expansions, or of masses formed by the accretion of successive layers of growth; thickness of a single layer 1 mm.; under surface a thin epitheca, concentrically wrinkled and striated. Cells tubular, cylindrical, oblique. Intercellular tissue vesiculose; near the base the vesicles are very irregularly disposed, and

more regularly disposed above, but not having the appearance of septate tubuli. Cell apertures arched or sub-triangular, diameter .25 mm., frequently nearly rectangular to the surface, often regularly arranged, alternating and sub-imbricating, separated by about the diameter of an aperture. The upper portion of the cell walls are exposed for .25 or .30 mm. Mesopores minute, margins scarcely elevated above the surface, and having, at the angles, minute nodes or granules. Surface marked by low, rounded monticules, the centers of which are distant about 6 mm., having a sterile space of 1.50 mm., in diameter, which is occupied by mesopores slightly larger than those between the apertures. The nodes or granules frequently obscure the mesopores so that the centers of the monticules and inter-apertural spaces have the appearance of a solid granulose surface.

This species may be distinguished from *Lichenalia colliculata* by the less elevated and more distant monticules, the non-radiation of the cells on the monticules, and the central sterile space; the inter-apertural space resembles that of *F. serrulata*, but it is easily distinguished from that species by its smaller and oblique cell apertures.

Formation and locality. Hamilton group, Western New York.

FISTULIPORA MINUTA (?).

PLATE LIX, FIGS. 5-8.

Compare *Fistulipora minuta*, ROMINGER. Proc. Acad. Nat. Sci. Phila., p. 120. May, 1866.
Thallostigma striata, HALL. Trans. Albany Institute, vol. x, p. 186. 1881.
" " " Report of State Geologist for 1883, p. 28. 1884.

ZOARIUM consisting of thin lamellate expansions, free or incrusting other objects, usually Cyathophylloid corals; thickness from .50 to 1 mm.; epitheca very thin, concentrically wrinkled. Cells tubular, at right angles to the surface, non-septate. Intercellular tissue vesiculose, vesicles comparatively large, irregularly disposed at the base, more regularly superimposed above, but not forming regular septate tubuli. Cell apertures oval, frequently obscurely sub-polygonal, length .25 mm., width generally about two-thirds the length, sometimes nearly equal to it, occurring at irregular intervals. Peristomes moderately strong, equally elevated, and when well

preserved having several nodes or short spinules. Mesopores usually minute, but sometimes equal in size to the cell apertures; margins elevated equally with the peristomes, and when well-preserved having minute nodes at the angles. Surface marked by low, rounded monticules, the centers of which are distant from each other about 4 mm., occupied by apertures and mesopores of the same size as those on other portions of the frond.

The surface of the frond presents a varying appearance according to the condition of preservation; when perfectly preserved the margins of the mesopores are elevated equally with the peristomes; the apertures and mesopores being so disposed as to give a striated appearance to the surface, and it is often difficult to distinguish the cell apertures from the mesopores; when the surface is worn or macerated the striated appearance is obscure or obsolete, and the cell apertures are very conspicuous, frequently somewhat obscurely disposed in quincunx order; in this condition of the frond the apertures frequently appear much larger than when perfectly preserved.

This species most nearly resembles *F. decipiens*, but may be distinguished by the smaller and more nearly oval cell apertures, and their disposition, which in connection with the mesopores, gives a striated appearance to the surface; the smaller mesopores, the smaller and more closely disposed monticules, and the uniform size of the cell apertures: when macerated it resembles *F. segregata*, but the cell apertures are smaller, more closely and regularly disposed: from *F. micropora* it is distinguished by the larger cell apertures and mesopores, and the coarser appearance of the frond: from *F. multaculeata* by the smaller and more broadly oval cell apertures, and the absence of prominent spinules on the peristomes and angles of the mesopores: from *F. densa* by the greater interval between the cell appertures, and the absence of maculæ composed of cells larger than on other portions of the frond: from *F. intercellata* of the Upper Helderberg group, it may be distinguished by the thinner and more elevated peristomes, the greater interval between the cell apertures, and the much larger mesopores: from *F. digitata* by the manner of growth, the greater interval between the cell apertures, and the absence of prominent nodes between the apertures.

Formation and locality. Hamilton group, Erie county, and at Delphi, N. Y.

Fistulipora spheroidea.

PLATE LVII, FIGS. 3, 4.

Thallostigma spheroidea, Hall. Trans. Albany Institute, vol. x, p. 187. 1881.
" " " Report of State Geologist for 1883, p. 31. 1884.

Zoarium usually consisting of spheroidal masses formed by the accretion of successive layers of growth; diameter of the largest specimen observed 45 mm., thickness of each layer from 2 to 10 mm. Cells tubular, cylindrical, in the thinner fronds curved, in the thicker fronds straight and at right angles to the surface for nearly their entire length; septa very infrequent and in many of the tubes entirely wanting. Intercellular tissue usually consisting of irregularly disposed vesicles, but where the cells are very near each other, they are regularly superimposed, appearing as septate tubuli, twenty-five or thirty septa in the space of 5 mm. Cell apertures circular or sub-polygonal from mutual pressure, closely and irregularly disposed, usually some portion of the margins in contact with adjacent cell apertures. Peristomes thin, distinctly and equally elevated, when well preserved having numerous short spinules. Interapertural space occupied by minute mesopores, which partially or entirely surround the apertures, frequently appearing like the interstitial cells of a Chætetes. Surface without monticules or maculæ.

The generally spheroidal form of this species will distinguish it from others of the genus Fistulipora, with the exception of *F. unilinea* and *F. hemispherica*; it bears a very close resemblance to the former, but may be distinguished by its somewhat larger cell apertures, their more crowded appearance, the spinules on the peristomes and the absence of maculæ destitute of cell apertures: from the latter by the circular or sub-polygonal cell apertures, their crowded arrangement, and the much smaller mesopores; in some conditions it is similar to *F. ponderosa* of the Lower Helderberg group, but the cell apertures are larger and the mesopores fewer in number; where the surface is well preserved the difference is more apparent: from *F. constricta* it is distinguished by

its manner of growth, the larger cell apertures, the much more prominent peristomes, and the absence of maculæ destitute of cell apertures.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

Fistulipora hemispherica.

PLATE LVII, FIGS. 8-11.

Callopora hemispherica, Hall. Trans. Albany Institute, vol. x, p. 183. 1881.
" " " Report of State Geologist for 1883, p. 17. 1884.

Zoarium consisting of hemispherical masses, the base attached to foreign bodies, usually Cyathophylloid corals; under surface consisting of a thin concentrically wrinkled epitheca. The largest specimen observed has a diameter of 25 mm. and a thickness of 12 mm. Cells tubular cylindrical; at the center they are at right angles to the epitheca, becoming more and more oblique as they approach the margin; non-septate; walls very thin, smooth. Intercellular space vesiculose, vesicles large and irregularly disposed near the base, regularly superimposed above, often appearing as septate tubuli, or as septa dividing the space between the cell tubes, the latter condition closely resembling a septate cell tube. Cell apertures oval, circular or obscurely trilobate, sometimes polygonal from mutual pressure, diameter .50 mm., closely and irregularly disposed, frequently in contact. Peristomes moderately strong, slightly elevated when the frond is well preserved; when worn or macerated they are much more prominent; many have a spine-like projection from .20 to .25 mm. in height, others, apparently equally well preserved, are smooth. Interapertural space occupied by angular pits, varying greatly in size and shape according to the position of the cell apertures; when the frond is well preserved they are often obsolete, or their margins appear as obscure ridges on the surface; when slightly worn or macerated they are very conspicuous. Surface marked by obscure monticules.

In shape this species resembles *F. spheroidea* and *F. unilinea*, but the mode of growth is different. The massive forms of those species being composed of

the superimposition of successive layers of growth, while in this species the cell tubes continue from the base to the surface without interruption; the apertures are usually oval or sub-trilobate, and the mesopores are larger and more variable in shape.

Formation and locality. Shales of the Hamilton group, York, Livingston county, N. Y.

Fistulipora constricta.

NOT FIGURED.

Lichenalia constricta, Hall. Trans. Albany Institute, vol. x, p. 183. 1881.
" " " Report of State Geologist for 1883, p. 36. 1884.

Zoarium consisting of explanate fronds, encrusting other bodies, generally Cyathophylloid corals and Crinoid columns, or of masses formed by the accretion of successive layers of growth. Cells tubular cylindrical, rectangular to the surface, non-septate; walls thin. Interapertural space vesiculose, near the base the vesicles are comparatively large and irregularly disposed, being much smaller and more regularly superimposed above, frequently appearing like septate tubuli, from sixty to one hundred septa in the space of 5 mm., near the surface almost in contact; the vesicles are more numerous than in any other species observed. Cell apertures circular, diameter about .25 mm., disposed in irregular intersecting lines, usually distant about two-thirds the diameter of an aperture. Peristomes thin, slightly elevated, and having on one side two minute denticulations, which in the course of growth form two parallel striations along the inner face of the cell walls. Interapertural surface elevated above the peristomes, angular or rounded, and occupied by minute, very shallow pits, which frequently appear oval or circular, generally one or two series between adjacent apertures, sometimes three, especially on or near the monticules.

When the frond is a little worn or macerated the interapertural surface is flattened and the pits have the usual angular form, diameter about .10 mm., sometimes even less. Surface marked by obtusely conical monticules, the centers of which are distant from each other about 5 mm., with a central

space about 1.50 mm. in diameter destitute of cell apertures and occupied by the minute mesopores, the apertures immediately adjacent being slightly larger than the others.

This species most nearly resembles *Lichenalia cornuta*, but may be distinguished by the larger cell apertures, the much less prominent denticulations, the elevated interapertural surface and the presence of mesopores: the cell apertures and denticulations are of nearly the same appearance as those of *L. ramosa*, but it may be distinguished by the elevated interapertural surface and the presence of mesopores: from *Fistulipora unilinea* by the much more prominent denticulations, the elevated interapertural surface, the different appearance of the mesopores, and the more frequent and prominent obtusely conical monticules.

Formation and localities. Hamilton group, four miles south of Le Roy, Genesee county, and York, Livingston county, N. Y.

Fistulipora multaculeata.

PLATE LIX, FIGS. 10, 11.

Thallostigma multaculeata, Hall. Report of State Geologist for 1883, p. 23. 1884.

Zoarium consisting of a thin foliaceous expansion, incrusting other objects, especially Cyathophylloid corals; the fronds observed are from .25 to .30 mm. in thickness, and have sometimes a digitate form. Cell apertures oval, length about .25 mm., width a little more than one-half the length; irregularly disposed, sometimes in contact, at other times separated by more than the width of an aperture. Peristomes strong, distinctly and equally elevated, and when well preserved having several small nodes or spinules. Mesopores small, from one to three series between adjacent apertures, but generally not more than two; margins elevated slightly less than the peristomes, and having similar nodes at their angles. Surface not marked by monticules or maculæ.

This species most nearly resembles *F. intercellata* of the Upper Helderberg group, but it may be distinguished by the somewhat larger and more distant

cell apertures, and the numerous spinules on the peristomes and at the angles of the mesopores; the resemblance, however, is very close, and with a comparison of more specimens it may perhaps be possible to unite the two forms: from *F. digitata* it is distinguished by the larger and more distant cell apertures, the more prominent peristomes, and the numerous spinules on the peristomes and at the angles of the mesopores: from *F. micropora*, by the larger cell apertures and more prominent peristomes, the comparatively smaller mesopores, and the numerous nodes of the peristomes and mesopores: from *F. segregata*, by the somewhat smaller, more decidedly oval and more closely disposed cell apertures, smaller mesopores, and numerous nodes of the peristomes and mesopores: from *F. involvens*, by the larger and more decidedly oval cell apertures, and the numerous nodes: from *F. minuta*, by its more closely disposed cell apertures, the much smaller mesopores, and the difference in the appearance of the nodes; the cell apertures and mesopores are never so arranged as to give to the surface a striated appearance, a feature which is characteristic of that species. From *F. mediopora* of the Lower Helderberg group, it is distinguished by its much smaller mesopores; and from *F. parasitica*, by the larger cell apertures and smaller mesopores.

Formation and locality. Hamilton group, Darien Centre, N. Y.

Fistulipora digitata.

PLATE LIX, FIGS. 12, 13.

Thallostigma digitata, Hall. Trans. Albany Institute, vol. x, p. 185. 1881.
" " " Report of State Geologist for 1883, p. 24. 1884.

Zoarium consisting of thin lamellate expansions incrusting other objects, especially Cyathophylloid corals; greatest thickness of fronds observed about .50 mm. All the specimens seen present a digitate appearance. Cell apertures oval, length about .20 mm., width from one-half to two-thirds the length, closely and usually irregularly disposed, but sometimes somewhat regularly arranged in diagonally intersecting rows, separated by a space equal to one-half the diameter of an aperture. Peristomes very thin, smooth, slightly elevated, the apertures often presenting a somewhat im-

mersed appearance. Mesopores very minute, generally only a single series between adjacent apertures. There are numerous, comparatively, very strong conical nodes, each one occupying the place of a mesopore, and frequently forming the most conspicuous feature of the surface.

This species may be distinguished from *F. multaculeata* by the smaller, more closely and regularly disposed cell apertures; the nodes are much stronger, fewer in number, and are situated not on the peristomes, but between the cell apertures, replacing a mesopore. From *F. densa* it may be distinguished by its smaller, less closely disposed cell apertures, less numerous and much more prominent nodes, and absence of monticules on which the cell apertures are larger than on other portions of the frond: from *F. segregata* by the smaller, more oval, much more closely and regularly disposed cell apertures, smaller mesopores and the prominent nodes: from *F. micropora* by the slightly larger, more decidedly oval, and more closely disposed cell apertures, comparatively smaller mesopores and prominent nodes: from *F. minuta* by the smaller, more decidedly oval cell apertures, smaller mesopores, and more prominent nodes, which are situated between the apertures, and not on the peristomes and margins of mesopores as in that species: from *F. involvens* by the somewhat larger, more oval and more closely disposed cell apertures, there being but a single series of mesopores between adjacent apertures, and also by the prominent nodes: from *F. intercellata*, of the Upper Helderberg group, by the smaller cell apertures, thinner peristomes and more prominent nodes: from *F. mediopora*, of the Lower Helderberg group, by the smaller cell apertures, much smaller mesopores, and more prominent nodes: from *F. parasitica*, of the same geological horizon, by the more closely and regularly disposed cell apertures and the prominent interapertural nodes.

Formation and locality. Hamilton group, West Hamburg, Erie county, N. Y.

FISTULIPORA DENSA.

NOT FIGURED.

Thallostigma densa, HALL. Trans. Albany Institute, vol. x, p. 186. 1881.
" " " Report of State Geologist for 1883, p. 25. 1884.

ZOARIUM consisting of thin lamellate expansions incrusting other objects, especially Cyathophylloid corals; greatest thickness observed .75 mm. Cell apertures broadly oval, sometimes nearly circular, often sub-polygonal, length .25 mm., width generally from two-thirds to four-fifths the length, very closely and generally irregularly disposed, though sometimes in comparatively straight lines; some portion of the margins of adjacent apertures are in contact. Peristomes thin, equally elevated. Mesopores minute, on the specimens observed never entirely surrounding an aperture, very frequently having the appearance of the interstitial cells of a MONOTRYPA. When the apertures are arranged in lines there are usually two mesopores between adjacent apertures longitudinally, but often only one. Surface marked by maculæ, the centers of which are distant from each other from 2 to 3 mm.; the apertures occupying these are larger and more nearly circular than the others, having a diameter of about .30 mm.

Some portions of the frond resemble *F. digitata*, but it may be distinguished from that species by the larger, sub-polygonal cell apertures, which are never entirely surrounded by mesopores, the maculæ, composed of larger cell apertures and the absence of prominent nodes: from *F. multaculeata* it is distinguished by the much closer arrangement of cell apertures, the smaller and fewer mesopores, which never entirely surround an aperture, the maculæ composed of larger cell apertures, and the absence of nodes on the peristomes and margins of mesopores: from *F. minuta* by the somewhat smaller and much more closely disposed cell apertures, fewer and smaller mesopores, and the absence of a striated appearance of the surface caused by the peristomes and margins of mesopores, a feature which is characteristic of that species: from *F. decipiens* by the more closely disposed cell apertures, the much fewer and smaller mesopores; the same features separate it from *F. mediopora* of the Lower Helderberg group: from *F. intercellata*, of the Upper Helderberg group, it is distin-

guished by the smaller, sub-polygonal, more closely disposed cell apertures, and its maculæ of larger cell apertures: from *F. micropora* and *F. segregata* by the much more closely disposed cell apertures, and the fewer mesopores, which never entirely surround an aperture.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

Fistulipora decipiens.

PLATE LIX, FIG. 9.

Thallostigma decipiens, Hall. Trans. Albany Institute, vol. x, p. 187. 1881.
" " " Report of State Geologist for 1883, p. 29. 1884.

Zoarium consisting of lamellate expansions, incrusting other objects, usually Cyathophylloid corals. Cells tubular, cylindrical, oblique or rectangular to the surface, always opening directly outward; the septa occur more frequently near the surface than in the lower portion of the cell tubes. Intercellular tissue vesiculose, vesicles comparatively large, and irregularly disposed near the base, more regularly superimposed above, but not having the appearance of septate tubuli, from four to six in the space of 1 mm. measured longitudinally. Cell apertures polygonal or sub-polygonal, diameter from .25 to .30 mm., irregularly disposed, sometimes in contact, at other times separated by nearly twice the diameter of an aperture. Peristomes thin, equally elevated. Mesopores variable in form and size, sometimes minute, at other times equal in diameter to the cell apertures; margins of the same height and thickness as the peristomes. Surface marked by broad, slightly elevated monticules, upon which the cell apertures and mesopores are of the same size as on other portions of the frond.

When the frond is well preserved it is frequently very difficult to distinguish the cell apertures from the mesopores, both being polygonal and often of the same size, the surface resembling that of a Paleschara; when the frond is worn the appearance is very different, the apertures being larger, less angular, more nearly circular, and much more conspicuous than the mesopores: without a very careful examination, it would naturally be supposed that this appearance of the fossil was due to an extremely thin Paleschara incrusting a Fistulipora, some portions being worn away, showing the Fistulipora be-

neath; but on different parts of the frond all the gradations between the extremes can be observed. This feature is also characteristic of the allied forms *F. minuta* and *F. ? subtilis.*

This species may be distinguished from *F. minuta* by the larger cell apertures and mesopores, and their more irregular disposition; in that species they are very frequently so arranged that the peristomes and margins of mesopores give to the surface a striated appearance: from *F. ? subtilis* it is distinguished by the larger size of the apertures and mesopores.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

FISTULIPORA ? SUBTILIS.

NOT FIGURED.

Thallostigma subtilis, HALL. Trans. Albany Institute, vol. x, p. 187. 1881.
" " " Report of State Geologist for 1883, p. 30. 1884.

ZOARIUM consisting of extremely thin foliaceous expansions incrusting other objects; thickness of observed fronds .25 mm. Cell apertures circular, oval or sub-polygonal, diameter or length .16 mm., irregularly disposed, sometimes in contact, at other times separated by three times the diameter of an aperture. Peristomes moderately strong, usually equally elevated, and sometimes having a comparatively strong node or spinule. Mesopores usually from one-half to two-thirds the size of the apertures; margins of the same height as the peristomes. The apertures and mesopores are sometimes so disposed that their margins give to the surface a striated appearance, and it is often difficult to distinguish the cell apertures from the mesopores, the frond having the appearance of a PALESCHARA.

This species resembles *F. decipiens* and *F. minuta*, but may be distinguished by its smaller cell apertures and mesopores, and the more delicate appearance of the frond.

Formation and locality. Hamilton group, West Williams, Ontario, Canada.

NOTE.—Dr. Rominger has described (loc. cit. under *F. minuta*) five species of FISTULIPORA from the Hamilton group of Michigan; two from the same horizon at Widder, Ontario, Canada, and two from Hamburg, Erie county, N. Y. I have had no opportunity of comparing the specimens of these species with those here described, and the comparison with the descriptions has not always proved satisfactory.

FAVICELLA, n. g.

Favicella inclusa.

PLATE LVIII, FIGS. 21, 22.

Thallostigma inclusa. Hall. Trans. Albany Institute, vol. x, p. 188. 1881.
" *inclusapora* (in error), Hall. Report of State Geologist for 1883, p. 33. 1884.

Zoarium consisting of thin lamellate expansions, free or incrusting other objects; thickness of observed specimens 1 mm. Cells tubular, cylindrical, for nearly one-half their length parallel with, and resting upon the epitheca, then somewhat abruptly bending, continue almost rectangular to the former portion, opening directly outward. Intercellular tissue vesiculose, apparently forming tubuli about two-thirds the diameter of the cell tubes, divided by thin, closely disposed septa. Cell apertures circular, diameter about .25 mm., usually regularly distant a little more than the diameter of an aperture. Peristomes slightly and equally elevated. Midway between the cell apertures are comparatively strong, sharply angular ridges, which unite and enclose the apertures in pentagonal or hexagonal vestibular areas. The surface between the ridges and apertures is flat and occupied by minute, angular mesopores, about ten in the space of 1 mm.

Surface marked by low monticules, the centers of which are distant from each other about 4 mm., and having cell apertures larger than those on other portions of the frond, the vestibular areas having a diameter of nearly 1 mm.

This is a characteristic form, and very distinct from any other at present known in this geological horizon, with the exception of *Fistulipora constricta*, which sometimes resembles it in having circular cell apertures, with thin, slightly elevated peristomes, surrounded by angular elevations; but it differs in having the whole interapertural space raised in angular elevations, with minute, obscure mesopores occupying every portion. It resembles *Selenopora circincta* and *S. complexa*, of the Upper Helderberg group, in having the cell apertures enclosed in polygonal areas, but in those species both the elevations and cell apertures are oblique, the apertures are strongly denticu-

lated, and there are no mesopores. This form, in its general features, has similar relations to the genus FISTULIPORA that SELENOPORA has to LICHENALIA.

Formation and locality. Shales of the Hamilton group, York, Livingston county, N. Y.

CERAMOPORA, HALL. 1852.

(See page 33.)

CERAMOPORA? (LICHENALIA) FOLIACEA.

PLATE LVII, FIGS. 6, 7.

Lichenalia foliacea, HALL. Trans. Albany Institute, vol. x, p. 183. 1881.
" " " Report of State Geologist for 1883, p. 35. 1884.

ZOARIUM consisting of a thin, foliaceous expansion, attached at the center to other bodies, the greater portion of the frond being free; under surface a thin epitheca, with strong concentric wrinkles, and radiating striations caused by the recumbent portions of the cell tubes. Cells tubular, gradually enlarging to the aperture, oblique to the surface. Intercellular tissue vesiculose. Cell apertures circular or broadly oval, diameter .33 mm., the width equal to three-fourths the length; on a plane with the surface or oblique, disposed in diagonally intersecting rows, usually alternating and imbricating. Peristomes moderately thick, sometimes equally elevated, but usually the posterior portion is the more strongly elevated and oblique, the upper part of the cell walls being sometimes exposed for a distance equal to the diameter of an aperture, or even more, angular and carinated, giving to the aperture a sub-triangular form. Inter-apertural space smooth. Surface marked by elongate maculæ, which are destitute of cell apertures, and occur at somewhat irregular intervals. The apertures immediately adjacent to these are larger than the others, having a diameter of .50 mm.

This species differs from *Ceramopora explanata*, of the Niagara group, in having smaller cells, which are less closely disposed, and less distinctly alternating and imbricating; the maculæ are much more distant and are destitute of cell apertures: from *Lichenalia stellata* it differs in having the apertures more regularly arranged in alternating and imbricating order; the maculæ are not elevated

and are more distant from each other: from *C. imbricella* in having the cells less oblique, less distinctly arranged in alternating and imbricating order, the maculæ more distant and destitute of cell apertures.

Formation and locality. Hamilton group, Western New York.

Ceramopora imbricella.

NOT FIGURED.

Lichenalia (Ceramopora) imbricella, Hall. Report of State Geologist for 1883, p. 37. 1884.

Zoarium consisting of a thin lamellate expansion, attached by the center of the under surface to foreign bodies, epitheca thin, with concentric undulations, and comparatively strong concentric, rounded striæ. Cells tubular, arising obliquely from the epitheca, gradually enlarging. Cell apertures very oblique, sometimes rectangular to the surface, broadly oval or circular, sometimes having an arched or triangular appearance, diameter about .40 mm., disposed in diagonally intersecting lines, regularly alternating and imbricating; upper portion of cell walls exposed for .50 to .66 mm., and having along the middle a comparatively strong carina. Surface marked by slightly elevated monticules, the centers of which are distant from each other from 6 to 7 mm. The apertures on the monticules are usually slightly larger than the others, and the cell wall is exposed for 1 mm. or more; they have sometimes an indistinct radiation, but usually the same general direction as those on other portions of the frond.

This species resembles *C.? (Lichenalia) foliacea*, but may be distinguished by having the cells more oblique to the surface, the upper portion of the cell walls more exposed, the maculæ elevated and entirely covered by cell apertures, which do not radiate from the center: from *Lichenalia pyriformis* it differs as follows; the cells regularly enlarge to the aperture, and are without denticulated processes: from *L. alternata* it is distinguished by its smaller and more nearly circular apertures; in that species they are elongate-oval.

Formation and locality. Hamilton group, near Alden, Erie county, N. Y.

PALESCHARA, HALL. 1874.

(See page 35.)

PALESCHARA PERTENUIS.*

NOT FIGURED.

Paleschara pertenuis, HALL. Trans. Albany Institute, vol. x, p. 179. 1881.
" " " Report of State Geologist for 1883, p. 7. 1884.

PALESCHARA INTERCELLA.

NOT FIGURED.

Paleschara intercella, HALL. Trans. Albany Institute, vol. x, p. 179. 1881.
" " " Report of State Geologist for 1883, p. 5. 1884.

PALESCHARA RETICULATA.

NOT FIGURED.

Paleschara reticulata, HALL. Trans. Albany Institute, vol. x, p. 179. 1881.
" " " Report of State Geologist for 1883, p. 6. 1884.

PALESCHARA VARIACELLA.

NOT FIGURED.

Paleschara variacella, HALL. Trans. Albany Institute, vol. x, p. 179. 1881.
" " " Report of State Geologist for 1883, p. 6. 1884.

PALESCHARA AMPLECTENS.

NOT FIGURED.

Paleschara amplectens, HALL. Trans. Albany Institute, vol. x, p. 179. 1881.
" " " Report of State Geologist for 1883, p. 7. 1884.

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* The descriptions of this and the following species of PALESCHARA are omitted, since the restriction in the number of pages to be included in the volume will not permit their insertion.

COSCINIUM, Keyserling. 1846.

Coscinium striatum, n. sp.

PLATE LXIV, FIGS. 13-16.

Zoarium consisting of an explanate frond, celluliferous on each face, with oval or circular perforations or fenestrules, at somewhat regular distances; length of fenestrules about 2 mm., width from 1.25 to 2 mm., generally distant transversely about 3 mm., longitudinally 4 mm.; transverse section between the fenestrules, broadly lenticular or acutely oval, greatest thickness 1.75 mm. Mesotheca thin, marked by arching undulations of growth and also by longitudinal striations, caused by the recumbent cell tubes. Cells tubular cylindrical, for about one-half their length parallel with, and resting upon the mesotheca, then abruptly bending and continuing at right angles to the axis, opening directly outward. Intercellular tissue vesiculose, vesicles minute, irregularly disposed, or regularly superimposed and having the appearance of septate tubuli. Cell apertures broadly oval, length .30 mm., width .20 mm., or more, irregularly disposed, generally separated by a little less than the diameter of an aperture. Peristomes thin, slightly and equally elevated, having on one side two minute denticulations, which in the course of growth, form two parallel striations along the inner face of the cell wall. In the cell apertures adjacent to the fenestrules the denticulations always proceed from the external margin. There is a non-celluliferous space of .75 mm. wide bordering each fenestrule. Interapertural space slightly convex, and in common with the non-celluliferous space around the fenestrules is striated; striæ fine, sinuous, interrupted, from three to six between adjacent cell apertures. Sometimes when the frond is worn so that the striæ are obsolete the vesicles are externally visible, appearing as minute angular pits.

This species may be distinguished from the ordinary forms of Coscinium by the striated surface, the size and form of the fenestrules, and their distance from each other. In general aspect it closely resembles *Coscinella elegantula*, but it

may easily be distinguished from that form by the oval cell apertures, the presence of denticulations, and the absence of inter-apertural pits: the peristomes, denticulations and absence of interapertural pits, distinguish it from *Coscinium cosciniforme.* It is the only species of the genus at present known, from the Upper Helderberg and Hamilton groups, having a distinctly striated surface.

Formation and locality. Hamilton group, Widder, Ontario, Canada.

COSCINELLA, NOV. GEN.

COSCINELLA ELEGANTULA.

PLATE LXIV, FIGS. 9-12.

ZOARIUM consisting of an explanate frond, celluliferous on each face, with perforations or fenestrules at somewhat regular distances from each other, the whole having the appearance of being composed of sinuous, anastomosing branches. Base spreading, adhering to Cyathophylloid corals or other bodies; pedicel cylindrical, short, diameter about 18 mm.; fronds large, fragments occurring which have a length of 80 mm. and a width of 110 mm. The fenestrules vary in form from circular to elongate-oval, length generally from 1.50 to 2 mm., width a little more than 1 mm., both larger and smaller fenestrules occurring, usually distant about 3.50 mm. A transverse section of the frond between the fenestrules is lenticular, greatest thickness 1.30 mm. The mesotheca is very thin, marked by arching undulations of growth and also by longitudinal striations, caused by the recumbent portion of the cell tubes. Cells tubular, cylindrical, for one-half their length parallel with, and resting upon the mesotheca, then abruptly bending and continuing rectangularly to their former course, opening directly outward. Intercellular tissue composed of tubuli, with very closely disposed septa, or of vesicles so disposed that they have the appearance of septate tubuli. Cell apertures circular, diameter .25 mm., closely disposed, very frequently in contact, seldom separated by more than one-half the diameter of an aperture, usually by not more than one-third, generally irregularly disposed, but sometimes forming

somewhat regular intersecting rows. Peristomes strong, equally elevated. The surface between the apertures, and a space about .70 mm. wide bordering each fenestrule, is occupied by minute angular pits; generally only one or two series between adjacent apertures, about twelve in the space of 1 mm.; margins about one-half the thickness of the peristomes and elevated equally with them. The non-celluliferous space at the posterior end of the fenestrule is always wider than at the anterior end.

This genus bears the same relations to the genus COSCINIUM that INTRAPORA does to STICTOPORA or FISTULIPORA to LICHENALIA. The manner of growth and structure is the same, except that the interapertural surface and a space bordering the fenestrules is occupied by angular pits or mesopores. It bears a very close resemblance to *Ptilodictya cosciniformis*, of Nicholson, but may be distinguished by the circular, and more distant cell apertures, and somewhat smaller fenestrules; in that species the apertures are elongate-oval and nearly or quite in contact: from *Coscinium striatum* it is distinguished by the presence of interapertural pits, and the absence of denticulations.

Formation and locality. Hamilton group, Widder, Ontario, Canada.

CERAMELLA, NOV. GEN.

CERAMELLA SCIDACEA, n. sp.

PLATE LXIV, FIGS. 5-8.

ZOARIUM consisting of an extremely thin foliaceous frond, proceeding from a spreading base, greatest thickness observed .30 mm. Celluliferous on each face. Cells tubular, arising very obliquely from the mesotheca. Intercellular tissue probably vesiculose. Cell apertures circular or very broadly oval, oblique, diameter .25 mm., seldom separated by more than half the diameter of an aperture, regularly disposed in quincunx order, alternating and imbricating. Peristomes strong, the upper portion of the cell wall carinated and frequently exposed for two-thirds its entire length, the carina sometimes projecting very slightly over the aperture. Surface marked by elongate depressed maculæ, which are sometimes disposed in alternating rows, each one having a length of from 3 to 5 mm., and a width of 1 mm., often lenti-

cular in form. The cells immediately adjacent to these have an indistinct radiation from them and are larger than the others.

The surface has a very close resemblance to *Ceramopora* (*L.*) *foliacea*, but the cell apertures are smaller, the maculæ more elongate-oval, and the frond is celluliferous on each face. From similar forms of the Niagara group this one may be distinguished by the elongate depressed maculæ. This is the only species of the genus at present known from any formation above the Niagara horizon.

Formation and localities. Hamilton group, Spurgen's Glen, Norton's Landing, Cayuga Lake and Darien Centre, N. Y.

STICTOPORA, HALL. 1847.

(See pages 37 and 90.)

STICTOPORA INCISURATA.

PLATE LX, FIGS. 1-18.

Stictopora incisurata, HALL. Trans. Albany Institute, vol. x, p. 189. 1881.
" " " Report of State Geologist for 1883, p. 38. 1884.
Stictopora indenta, HALL. Trans. Albany Institute, vol. x, p. 189. 1881.
" " " Report of State Geologist for 1883, p. 40. 1883.
Stictopora obliqua, HALL. Trans. Albany Institute, vol. x, p. 189. 1881.
" " " Report of State Geologist for 1883, p. 39. 1884.
Stictopora multipora, HALL. Trans. Albany Institute, vol. x, p. 190. 1881.
" " " Report of State Geologist for 1883, p. 43. 1884.

ZOARIUM consisting of a flattened, dichotomously branched frond, proceeding from a spreading base; distal extremities of branches obtuse; transverse section varying from narrow lenticular to acutely oval. Branches varying from 2 to nearly 6 mm. in width, margins slightly diverging, frequently almost parallel, thickness from .50 to 1 mm.; width of noncelluliferous space at margin usually less than .50 mm. On some fronds the bifurcations are frequent, occurring at intervals of from 7 to 10 mm., but usually they are more distant, and often a branch continues, without bifurcating, for 30 or 40 mm., and rarely even more. Mesotheca thin, with sharp, divergent, longitudinal striations, caused by the recumbent portion of the cell tubes, and strong, arching undulations of growth. Cells tubular, recumbent for the greater portion of their length, then turning abruptly outward, opening

parallel with, or obliquely to the surface. Intercellular space occupied by irregularly disposed vesicles. Cell apertures varying from elongate-oval to nearly circular, disposed in longitudinal, divergent lines, increasing by interstitial additions; apertures of marginal rows larger than the others. Peristomes strong, equally or unequally elevated. Ranges of apertures separated by more or less prominent ridges, which often continue obliquely across the non-celluliferous space, and with the adjacent margins extend beyond the other portions, giving to the border a sinuate appearance.

The variations of this species are so great that where only the extremes are observed, they would naturally be regarded as belonging to different species. On some fronds the cell apertures are circular, diameter about .18 mm., separated by more than twice the diameter of an aperture; on others they are oval, length .35 mm., width a little more than one-half the length, margins in contact: all intermediate forms occur. On some fronds the ranges of apertures are separated by slender, slightly elevated striations, on others by broad flattened ridges, wider than the apertures and obscuring them, on still others by two or more striations, frequently one of the striations passing obliquely between two apertures, and uniting with adjacent striations; on most of the fronds these markings are narrow, rounded and prominent. Upon those fronds originally described as *S. obliqua* (pl. lx, fig. 3), the ridges are slightly elevated or frequently obsolete, the posterior portion of the peristomes is much the more prominent, the apertures being very oblique and seemingly irregularly disposed, varying greatly in appearance from the forms represented by figs. 7–13 of pl. lx. The forms described as *S. multipora* are very narrow, having a width of only 2 mm., the apertures are minute, circular, diameter .15 mm., very closely disposed, sixteen apertures in the space of 5 mm., being twice the number that occur in the same space on some other forms of the species. Peristomes sometimes smooth, at other times denticulated; on some fronds the denticulations are invariably situated within the exterior margin of the aperture, are very slender, not elevated above the peristome, frequently continuing nearly across the opening, and in the course of growth forming two parallel ridges along the inner face of the cell walls (pl. lx, figs, 13, 14); on other fronds the denticula-

tions proceed from the posterior part, and are elevated above the peristome, obscuring the cell opening (pl. lx, fig. 16). In the collections made from the Hamilton group this is by far the most common species of STICTOPORA.

This species most closely resembles *S. Gilberti*, of the Upper Helderberg group, but the branches are usually narrower, the bifurcations less frequent, the margins straighter, much more gradually diverging, and are frequently notched or serrated: from *S. ovatipora* it is distinguished by its usually wider branches; the less nearly parallel rows of apertures, and the margins of the fronds are notched or serrated: from *S. sinuosa*, by the continuous longitudinal ridges: from *S. granifera*, by the continuous longitudinal ridges and absence of granules on the ridges and peristomes: from *S. palmipes*, by the different manner of growth, narrower and thicker non-celluliferous margins, and the absence of nodes or spinules on the longitudinal ridges.

Formation and localities. Hamilton group, Lodi landing, Seneca county; North Bristol, Ontario county; near Geneseo, Livingston county; Darien Centre, Erie county; Bellona, Yates county; near Norton's landing, Cayuga county; near Canandaigua lake, Ontario county; Borodino, Onondaga county, and other localities in Central and Western New York.

STICTOPORA TRILINEATA, n. sp.

PLATE LXI, FIGS. 26, 27.

ZOARIUM consisting of a flattened, dichotomously branched frond arising from a spreading base, or from several rootlets attached to foreign bodies; for 2 or 3 mm. above the base the stipe is cylindrical and has a diameter of about 1 mm., it then bifurcates and becomes flattened. Branches from 2 to 2.50 mm. in width, the margins essentially parallel, scarcely expanding before bifurcating; non-celluliferous marginal space very narrow, width less than .50 mm.; transverse section of a branch lenticular, greatest thickness observed .75 mm.; marginal angles acute; bifurcations frequently distant 10 or 12 mm.; branches usually diverging at an angle of about sixty degrees; on some of the fronds, near the base, there are occasionally lateral branches which diverge at an angle of ninety degrees. Cells tubular, for a portion of their length nearly parallel with the epitheca, then abruptly curving and opening

directly outward. Intercellular space occupied by irregularly disposed vesicles. Cell apertures oval, length about .18 mm., width two-thirds the length, disposed in regular longitudinal rows, about eight rows on each face of the branch; apertures of the marginal rows slightly larger than the others, and are sometimes indistinctly trilobate in form. Peristomes thin, distinctly and equally elevated, usually smooth, but sometimes with indications of slight denticulations on the posterior wall. The non-celluliferous margin and interapertural space are marked by thin sharp striations, which are elevated equally with the peristomes; from two to four striations between adjacent ranges of apertures, often presenting an irregular appearance: the lower portion of the frond, for the space of 10 mm. or more, is very frequently entirely covered by the striations, and sometimes nearly the entire frond is similarly marked, the cell apertures sometimes faintly showing beneath, but very often they are obsolete or covered.

This species may be distinguished from *S. incisurata* by the more nearly parallel margins and ranges of apertures, the finer and more numerous longitudinal striations, the narrower and finely striated non-celluliferous margin which is entire, never notched or serrated. It most nearly resembles *S. tumulosa*, but may be distinguished by the larger, more oval cell apertures, which never, so far as observed, have a pustuliform appearance, and by the more numerous longitudinal striations over the greater portion of the frond: from *S. incrassata*, by its more slender form, smaller cell apertures, narrower non-celluliferous margin, and the numerous longitudinal striations: from *S. rigida*, of the Upper Helderberg group, by the less rigid appearance of the frond, the flat interapertural space, and the finer, more numerous striæ: from *S. crescens*, by the presence of fine striations in place of prominent ridges: from *S. interstriata*, by the coarser and continuous longitudinal ridges: from the other species, at present known, from the Lower and Upper Helderberg and Hamilton groups, it may be distinguished by the flat interapertural space, and the fine, somewhat irregular longitudinal ridges.

Formation and localities. In the shales of the Hamilton group, Moscow, Livingston county, and near Canandaigua Lake, N. Y.

Stictopora rectalinea.

PLATE LXIII, FIG. 23.

Zoarium consisting of a flattened dichotomously branched frond, arising from a spreading base. Branches about 3 mm. in width; margins parallel, the branches not expanding before bifurcating; non-celluliferous marginal space very narrow, flat, width about .25 mm.; transverse section lenticular, abruptly narrowing near the margins, the remaining portion regularly convex, greatest thickness .75 mm.; bifurcations comparatively distant, branches diverging at an angle of about forty-five degrees. Cells tubular, cylindrical, for about one-half their length parallel with the axis, then abruptly turning and opening almost directly outward; the marginal cells are a little oblique to the axis of the branch, the others are parallel. Intercellular tissue vesiculose; vesicles irregularly disposed, more compactly arranged near the surface than below. Cell apertures oval, length about .20 mm., width a little more than one-half the length, sometimes two-thirds, disposed in parallel longitudinal rows, eleven or twelve rows on each face of the branch; marginal apertures larger and more nearly circular than the others; apertures separated longitudinally by a space about equal to their diameter; in the central rows there are fourteen in the space of 5 mm., in the marginal rows there are eight or more in the same space. Peristomes thin, in the central rows, scarcely elevated, with evidences of two slight denticulations within the outer margin. The apertures frequently appearing immersed; approaching the margin the peristomes become more distinct, the outer portion being the most strongly elevated and denticulated. The space between the rows of apertures is a little more than twice the width of an aperture, convex or sub-angular and striated: the striæ are very fine, minutely granulose, three or four between adjacent rows.

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Formation and locality. Hamilton group, West Williams, Ontario, Canada.

Stictopora tumulosa.

PLATE LXI, FIGS. 18-22.

Zoarium consisting of a flattened, dichotomously branched frond, arising from a spreading base; branches from 2.50 to a little more than 3 mm. in width, not expanding before bifurcating; margins parallel; extremities acutely rounded; width of non-celluliferous marginal space a little less than 50 mm.; transverse section flattened-lenticular, abruptly contracting near the margins, greatest thickness .50 mm.; bifurcations on the specimens observed distant, occurring at intervals of from 12 to 20 mm. or more; branches diverging at an angle of about forty-five degrees. Cells tubular, nearly parallel with the mesotheca for the greater portion of their length, then abruptly turning and opening directly outward. Intercellular tissue vesiculose, vesicles irregularly disposed. Cell apertures circular, pustuliform, diameter of the opening from .12 to .15 mm., of the pustules about .25 mm., disposed in parallel, longitudinal rows, very frequently alternating and forming oblique, transverse rows; apertures of the marginal rows a little larger than the others, having a diameter of about .18 mm. Peristomes thin, slightly and equally elevated, not denticulated. Ranges of apertures separated by thin, moderately elevated striations, of which there are usually one or two between adjacent rows, but occasionally more; these are generally continuous, but sometimes tortuous and interrupted, and occasionally so numerous as to somewhat obscure the cell apertures. Sometimes the cell apertures are very prominent, the bases of the pustules being in contact and presenting a crowded or confused appearance.

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Formation and locality. Hamilton group, Moscow, Livingston county, N. Y.

Stictopora striata, n. sp.

PLATE LXIII, FIG. 22.

Zoarium consisting of a flattened dichotomously branched frond arising from a spreading base. Branches from 3 to 4 mm in width; margins sometimes

parallel, at other times slightly diverging, the greatest increase in width in a length of 15 mm. being 1 mm.; non-celluliferous marginal space narrow, width .25 mm., not flat; transverse section regularly convex on the two sides, greatest thickness .50 mm.; bifurcations comparatively distant; branches diverging at an angle of sixty degrees or more. Cells tubular, for the greater portion of their length very oblique, often nearly parallel to the mesotheca, then turning and opening a little obliquely to the surface, on the narrower portion of the branches frequently recumbent for nearly their entire length. Intercellular tissue vesiculose; vesicles irregularly disposed, more compactly arranged near the surface than below. Cell apertures very broadly oval, often circular, sometimes slightly pustuliform, length .25 mm., width from .18 to .25 mm, disposed in somewhat irregular longitudinal rows, but the rows being very close together and the apertures forming them being separated by more than twice their diameter, the arrangement is indistinct; they sometimes alternate and form oblique transverse rows, and often irregular, direct transverse rows; the apertures forming these are closely disposed, generally nearly or quite in contact; the marginal apertures are very little, if at all larger than the others. Peristomes moderately thick, strongly elevated, the posterior portion being the most prominent, not denticulated, smooth. Interapertural and marginal space striated; striæ short, tortuous, interrupted, length from .25 to 1 mm., from eight to ten in the space of 1 mm. measured transversely; they are abruptly rounded, slightly elevated, the peristomes being very prominent above them.

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Formation and locality. Hamilton group, Ontario county, N. Y.

Stictopora sinuosa.

PLATE LXI, FIG. 17.

Stictopora sinuosa, Hall. Trans. Albany Institute, vol. x, p. 190. 1881.
" " " Report of State Geologist for 1883, p. 42. 1884.

Zoarium consisting of a flattened, dichotomously branched frond of somewhat rigid appearance; bifurcations occurring at intervals of about 7 mm.

Branches 2 mm. in width, diverging at an angle of forty-five degrees; margins essentially parallel; non-celluliferous marginal space very narrow or obsolete; transverse section lenticular, greatest thickness observed a little less than 1 mm. Cells tubular, arising very obliquely from the mesotheca. Inter-cellular space occupied by irregularly disposed vesicles. Cell apertures broadly oval, often nearly circular, length .25 mm., disposed in sub-regular longitudinal lines, sometimes alternating and forming obliquely transverse rows, six apertures in the space of 5 mm. measured longitudinally; apertures of the marginal rows slightly larger and more distant than the others. Peristomes strong, posterior portion the more elevated. Apertures separated by sinuous, interrupted longitudinal ridges, which are elevated equally with the peristomes.

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Formation and locality. Hamilton group, south of Auburn, shore of Cayuga lake, N. Y.

Stictopora ovata, n. sp.

PLATE LXIII, FIG. 24.

Zoarium consisting of a flattened dichotomously branched frond, proceeding from a spreading base; branches about 3.50 mm. in width; margins parallel, not expanding before bifurcating; non-celluliferous margin narrow, width less than .40 mm.; transverse section of the branch broadly lenticular or somewhat acutely oval, greatest thickness about 1.30 mm.; bifurcations comparatively distant, some of the branches continuing 25 mm. or more without bifurcating; bifurcations diverging at an angle of from thirty to forty-five degrees. Cells tubular, short, arising obliquely from the mesotheca, curving and opening directly outward, gradually enlarging to the aperture. Inter-cellular tissue consisting of irregularly disposed vesicles. Cell apertures broadly ovate, the broader end toward the base of the frond, length .35 mm., width three-fourths the length, regularly disposed in parallel longitudinal rows, frequently alternating and forming oblique transverse rows; longitudinally distant from .30 to .50 mm.; transversely they are separated

by about one-third the width of an aperture; generally seven or eight longitudinal rows on a branch; the apertures of the marginal rows are not larger than the others. Peristomes moderately thick, distinctly elevated, the posterior portion the more prominent, oblique, not denticulated, and on the specimens observed smooth. The narrow space between the ranges of apertures is flat or slightly concave, with a thin, angular, sinuous striation along the middle, usually continuous, but on portions of the frond sometimes interrupted and tortuous, occasionally having the appearance of entirely surrounding an aperture.

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Formation and locality. Hamilton group, near the head of Canandaigua lake, N. Y.

Stictopora incrassata.

PLATE LXII, FIGS. 1-6.

Stictopora incrassata, Hall. Trans. Albany Institute, vol. x, p. 190. 1881.
" " " Report of State Geologist for 1883, p. 47. 1884.

Zoarium consisting of a flattened, dichotomously branched frond, proceeding from a spreading base attached to foreign bodies. Branches generally from 3 to 3.50 mm. in width: margins parallel, except for a short distance below a bifurcation, where they are slightly expanded; non-celluliferous marginal space a little more than .50 mm. in width; transverse section oval or broadly lenticular, greatest thickness 1.60 mm., sometimes one face of the branch is more convex than the other; bifurcations distant, occurring at intervals of from .15 to .25 mm. on the specimens observed. Cells tubular, short, arising obliquely from the mesotheca at an angle of about forty-five degrees, curving and opening directly outward, gradually enlarging to the apertures. Intercellular tissue vesiculose; vesicles irregularly disposed. Cell apertures ovate, the smaller end toward the base of the frond, length .50 mm., width a little more than one-half the length; frequently operculate, the opercula consisting of thin, flat or slightly convex plates, extending across the apertures, and having one or two very prominent, sub-conical nodes, which are more frequently situated near the margin than at the

center of the aperture. Peristomes thin, distinctly and equally elevated, not denticulated, sometimes finely granulose or with minute nodes. Cell apertures regularly disposed in parallel longitudinal rows, from six to eight rows on a branch, generally seven; longitudinally the apertures are in contact; transversely they are separated by about half the diameter of an aperture; the apertures of the marginal rows are only a very little larger than the others. The space between the rows of apertures is generally flat or slightly concave, with a fine angular striation along the middle; sometimes smooth, at other times the whole space is elevated and angulated; when well preserved the surface is finely granulose.

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Formation and locality. Hamilton group, West Williams, Province of Ontario, Canada.

Stictopora limata, n. sp.

PLATE LXI, FIGS. 14-16.

Zoarium consisting of a flattened, dichotomously branched frond, proceeding from a spreading base attached to foreign bodies. Branches a little more than 1.50 mm. in width; margins parallel, the branches not widening before bifurcation; non-celluliferous marginal space extremely narrow, not wider than .20 mm.; transverse section lenticular, angles at the margins very acute, greatest thickness observed about .50 mm.; bifurcations comparatively distant, branches continuing for 15 mm. or more before bifurcating. Cells tubular, parallel with the mesotheca for a portion of their length, then abruptly curving and opening directly outward. The intercellular tissue consists of irregularly disposed vesicles. Cell apertures oval, length about .15 mm., width a little more than one-half of the length, disposed in longitudinal parallel rows, separated longitudinally by the length of an aperture; transversely by twice the width of an aperture; five rows on each face of of the branch; the apertures of the outer rows are larger than the others, having a diameter of .25 mm., and are sometimes slightly oblique to the axis of the branch. Peristomes thin, slightly and equally elevated; there are occasionally slight evidences of minute denticulations from the inner face of

the peristomes. Rows of apertures separated by prominent, rounded, smooth ridges, having twice the width of the cell apertures.

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Formation and locality. Hamilton group, Darien Centre, N. Y.

STICTOPORA SUBRIGIDA.

PLATE LX, FIG. 21.

Stictopora subrigida, HALL. Trans. Albany Institute, vol. x, p. 190. 1881.
" " " Report of State Geologist for 1883, p. 43. 1884.

ZOARIUM consisting of a flattened, dichotomously branched frond; the base is composed of several rootlets, which are attached to foreign bodies; for a short distance from the base the stipe is broadly oval, not expanding before bifurcating; branches about 1.50 mm. in width, margins parallel; transverse section lenticular, greatest thickness observed .75 mm.; non-celluliferous marginal space narrow, margin frequently crenulated; bifurcations comparatively very distant, sometimes occurring at intervals of 15 mm. or even more; branches diverging at an angle of about sixty degrees. Cells tubular, for a portion of their length nearly parallel with the mesotheca, then abruptly turning and opening directly outward. Intercellular space occupied by irregularly disposed vesicles. Cell apertures circular, minute, diameter .10 or .12 mm., somewhat pustuliform, disposed in parallel longitudinal rows, five or six on each face of the branch; apertures separated longitudinally by more than twice their diameter. Peristomes thin, slightly and equally elevated, not denticulated on the specimens observed. Ranges of apertures separated by prominent, rounded ridges, having a width greater than the diameter of an aperture, and forming the most prominent feature of the frond.

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Formation and localities. Hamilton group, near Middleburg, Schoharie county, and railroad cutting, two and a half miles east of Alden station, Erie county, N. Y.

Stictopora crenulata.

PLATE LX, FIG. 22.

Stictopora crenulata, Hall. Report of State Geologist for 1883, p. 44. 1884.

Zoarium consisting of a flattened, frequently sinuous, dichotomously branched frond, arising from a base composed of several rootlets attached to foreign bodies; the frond for a little more than 1 mm above the base is subelliptical in section, striated, non-celluliferous, then becoming flattened. Branches about 1.50 mm. wide; non-celluliferous marginal space very narrow, width .25 mm.; margins essentially parallel, frequently crenulated, the branches scarcely expanding before bifurcation; transverse section lenticular, abruptly contracting near the margin, the angles very acute, the remaining portion regularly convex; bifurcations comparatively distant; branches widely diverging. Intercellular tissue consisting of irregularly disposed vesicles. Cell apertures a little oblique, circular, diameter about .18 mm., arranged in parallel longitudinal rows, separated by about twice the diameter of an aperture, usually five or six rows on a branch; the apertures of the marginal rows are larger than the others and more oblique, the upper portion of the cell walls frequently being exposed for a distance equal to twice the diameter of an aperture. In the central ranges there are fifteen apertures in the space of 5 mm., in the outer ranges nine or ten in the same space; opposite each of these cells the margin is extended, giving to it a crenulated appearance. Peristomes thin, nearly equally elevated, the posterior portion being slightly the more prominent. Space between the ranges of apertures flat or slightly convex, striated, generally three thin, angular striations between adjacent rows of apertures.

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Formation and locality. Hamilton group, near Alden, Erie county, N. Y.

Stictopora angularis, n. sp.

PLATE LXI, FIG. 23.

Zoarium consisting of a flattened dichotomously branched frond, arising from a spreading base. Branches from 2 to 2.50 mm. in width: margins essentially

parallel, scarcely expanding before bifurcating; transverse section lenticular, sub-angular at the middle, somewhat abruptly contracting near the margins; angles very acute; non-celluliferous marginal space about .33 mm. in width; bifurcations occurring at intervals of from 5 to 7 mm. on the specimens observed; branches diverging at an angle of about forty-five degrees. Cells tubular, for part of their length recumbent, then abruptly curving and opening directly outward. Intercellular space occupied by irregularly disposed vesicles. Cell apertures circular or very broadly oval, pustuliform; disposed in nearly parallel longitudinal rows, and separated by two or three times the diameter of an aperture; at the center of the branch they have a diameter of about .15 mm., those of the marginal rows are larger, having a diameter of about .22 mm.; diameter of the pustules .25 mm., increasing to .35 mm. Peristomes thin, very slightly elevated. Ranges of apertures separated by prominent, rounded ridges, having a width equal to or greater than the diameter of an aperture, and elevated equally with the pustules.

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Formation and locality. Hamilton group, four miles south of Le Roy, Genesee county, N. Y.

Stictopora recta, n. sp.

NOT FIGURED.

Zoarium consisting of a flattened dichotomously branched frond. Branches from 1 to 1.25 mm. in width, margins parallel, the branches not expanding before bifurcating; transverse section lenticular, abruptly contracting near the margins, greatest thickness .33 mm.; non-celluliferous space at the margin very narrow or obsolete; bifurcations comparatively distant, occurring at intervals of about 6 mm. on the specimens observed; branches diverging at an angle of forty-five degrees. Cells tubular, arising very obliquely from the mesotheca, abruptly curving and opening directly outward. Intercellular tissue vesiculose; vesicles irregularly disposed. Cell apertures oval, length about .18 mm., or slightly less, width a little more than one-half the length; regularly disposed in parallel longitudinal rows, separated by less than the

length of an aperture; five or six ranges on each face of the branch. The apertures of the marginal ranges are a little larger and more prominent than the others. Rows separated by prominent granulose or nodulose ridges, which have a width equal to that of the cell apertures; granules numerous, irregularly disposed. The ridges frequently partially obscure the apertures.

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Formation and locality. Hamilton group, West Hamburg, Erie county, N. Y.

Stictopora bifurcata, n. sp.

PLATE LXIII, FIG. 17.

Zoarium consisting of a flattened, dichotomously branched frond, proceeding from a spreading base. Branches from 1 to about 1.50 mm. in width, with the margins sub-parallel, only slightly expanding before bifurcation; non-celluliferous marginal space very narrow or obsolete; transverse section lenticular, greatest thickness a little less than .50 mm.; bifurcations frequent, sometimes occurring at intervals of 3 mm; from the frequency of the bifurcations the branches have occasionally the appearance of trifurcating. Cells tubular, opening directly outward. Intercellular tissue vesiculose, vesicles irregularly disposed. Cell apertures oval, length about .20 mm., width about one-half the length, disposed in longitudinal sub-parallel rows, from five to seven rows on a branch; apertures of the marginal rows a little larger than the others, having a length of .25 mm. Peristomes thin, the posterior portion a little the more strongly elevated, but not denticulated on the specimens observed. Ranges of apertures separated by prominent, moderately strong, nodose ridges, which frequently very much obscure the cell apertures; nodes small, regularly distant, about twenty in the space of 5 mm.

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Formation and locality. Hamilton group, near Muttonville, North Bristol township, Ontario county, N. Y.

STICTOPORA PALMIPES.

PLATE LX, FIGS. 19, 20.

Stictopora palmipes, HALL. Trans. Albany Institute, vol. x, p. 189. 1881.
" " " Report of State Geologist for 1883, p. 41. 1884.

ZOARIUM consisting of a flattened, dichotomously branched frond; base thin, spreading, attached to foreign bodies; for a distance of 2 mm. above the base the stipe is nearly cylindrical, with a diameter of less than 1 mm., then rapidly expanding to a width of 3 mm. The mode of growth is different from that of the usual forms of STICTOPORA; in addition to the ordinary bifurcating branches there are intermediate lateral branches or lobed expansions, which are very short, not exceeding 1.50 mm. in length and generally about 1 mm. wide, with the extremities, rounded; transverse section lenticular, greatest thickness observed .50 mm.; the non-celluliferous margin is flat, very thin, having a width .50 mm or more, bordering the entire frond, occupying all the space between the lobes or lateral branches; the celluliferous portion has thus somewhat the appearance of incrusting a flat, smooth surface. Cells tubular, recumbent, for a portion of their length abruptly curving and opening directly outward. Intercellular tissue consisting of irregularly disposed vesicles. Cell apertures oval, length about .20 mm., width a little more than one-half the length, disposed in regular longitudinal rows, the apertures of the marginal rows being a little larger than the others. Peristomes thin, equally elevated, not denticulated on the fronds observed. Rows of apertures separated by prominent ridges, having a width of .10 mm or more, much elevated above the peristomes, and very frequently partially obscuring the apertures and having conspicuous, equi-distant, conical nodes, ten in the space of 5 mm.

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Formation and localities. Shales of the Hamilton group, West Hamburg, Erie county; Pavilion, Genesee county, and near Canandaigua lake, Ontario county, New York.

STICTOPORA LOBATA, n. sp.

NOT FIGURED.

ZOARIUM consisting of a flattened, dichotomously branched frond, proceeding from a spreading base, which is attached to foreign objects. Branches from 2 to 2.50 mm. in width, margins sub-parallel, the branches slightly expanding before bifurcating; non-celluliferous marginal space narrow, width a little more than .25 mm.; transverse section lenticular, greatest thickness .75 mm.; on the margins of the branches, at intervals of a little more than 1 mm., are lobes or projections, extending beyond the margin about .75 mm., and having a width of about 2 mm.; they have the appearance of aborted lateral branches; the cell apertures upon them extend entirely to the margin; bifurcations comparatively infrequent, occurring at intervals of 8 mm. or more on the specimens observed. Cells tubular, recumbent for the greater portion of their length, then abruptly turning and opening directly outward. Intercellular tissue consisting of irregularly disposed vesicles. Cell apertures oval, length about .20 mm., width from one-half to two-thirds the length, disposed in longitudinal, nearly parallel rows, about six rows on each face of the branch; apertures of the rows separated by less than their length; the apertures on the lobes are larger and less regularly disposed. Peristomes strong, posterior portion a little the more elevated, smooth, not denticulated. Ranges of apertures separated by prominent, narrow, nodose ridges, which have a width of about two-thirds that of the apertures; nodes small, regularly disposed, about equal in number to the cell apertures.

In its manner of growth this species most nearly resembles *S. palmipes*, but the lobes are never prolonged into lateral branches, the frond is more rigid in appearance, the margins more nearly parallel, and the frond is without the thin, wide, non-celluliferous marginal space characteristic of that species; from other species it may be distinguished by its marginal lobes.

Formation and locality. Reed's Corners, near Canandaigua lake, Ontario county, N. Y.

STICTOPORA GRANIFERA.

PLATE LXI, FIGS. 1-6.

Stictopora granifera, HALL. Trans. Albany Institute, vol. x, p. 191. 1881.
" " " Report of State Geologist for 1883, p. 45. 1884.

ZOARIUM consisting of a flattened, dichotomously branched frond. Branches above a bifurcation 2.50 to 3 mm. in width, increasing to 4 or 5 mm.; on some of the fronds there are slight contractions in the branch at frequent intervals; transverse section flattened-lenticular, greatest thickness observed about .40 mm.; non-celluliferous marginal space very narrow. Cells tubular, length about 1.50 mm., for the greater portion of their length nearly parallel with the mesotheca, then turning abruptly and opening directly outward Inter-cellular space occupied by irregularly disposed vesicles. Cell apertures oval, length about 33 mm., width a little more than one-half the length; closely and irregularly disposed, frequently in contact, never distant more than the width of an aperture. Peristomes strong, equally elevated, and having eight to ten minute nodes or granules. On the non-celluliferous margin, and on the surface between the cell apertures there are comparatively frequent, interrupted, longitudinal, granulose striations of about the same thickness and height as the peristomes. When the frond is well preserved the striations and peristomes are so similar in appearance that it is often very difficult to distinguish the limits of the cell apertures.

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Formation and localities. Hamilton group, near Pavilion village, Genesee county, and Muttonville, North Bristol township, Ontario county, N. Y.

STICTOPORA DIVERGENS, n. sp.

PLATE LXIII, FIGS. 18, 19.

ZOARIUM consisting of a flattened dichotomously branched frond, arising from a spreading base, or from several rootlets attached to foreign bodies; some of the fronds are a little sinuous in their manner of growth. Branches from 1.50 to 2 mm. in width; margins slightly divergent, expanding but little before bifurcation; non-celluliferous marginal space extremely narrow or obsolete;

transverse section lenticular or flattened oval, greatest thickness about .50 mm.; bifurcations frequent, branches widely diverging. Cells tubular, arising obliquely from the mesotheca, curving and opening directly outward. Intercellular tissue consisting of irregularly disposed vesicles. Cell apertures oval, length a little more than .25 mm., width a little less than two-thirds the length, disposed in longitudinal lines, separated by from once and one-half to twice the length of an aperture, usually having the appearance of being irregularly disposed; transversely the apertures are very frequently in contact. Peristomes moderately thick, distinctly and equally elevated, not denticulated; when well preserved the summits have from seven to ten minute nodes or granules. The interapertural space is marked by interrupted longitudinal striations, of about the same thickness and height as the peristomes, which frequently somewhat obscure the cell apertures. When well preserved these striæ are granulose; granules similar to those of the peristomes.

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Formation and locality. Hamilton group, Darien Centre, N. Y.

Stictopora permarginata.

PLATE LXIII, FIG. 16.

Stictopora permarginata, Hall. Trans. Albany Institute, vol. x, p. 191. 1881.
" " " Report of State Geologist for 1883, p. 46. 1884.

Zoarium consisting of flattened, dichotomously branched fronds, arising from a spreading base, or from rootlets attached to foreign bodies. Branches from 1.25 to 1.75 mm. in width, with parallel margins, not expanding before bifurcating; non-celluliferous marginal space extremely narrow or obsolete; transverse section broadly lenticular or oval, greatest thickness .75 mm.; marginal angles not acute; bifurcations infrequent, sometimes occurring at intervals of 15 mm. or more; branches diverging at an angle of about sixty degrees. Cells tubular, gradually enlarging to the aperture; for about one-half their length nearly parallel with the mesotheca, then abruptly turning and opening outward. Intercellular tissue consisting of irregularly disposed vesicles. Cell apertures oval, length .25 or .30 mm., width about one-half the length,

closely and irregularly disposed, often in contact, sometimes forming very irregular transverse rows; apertures forming the rows with their margins in contact. Peristomes comparatively very thick, converging, equally elevated, not denticulated, when well preserved having several conspicuous nodes or granules. On the interapertural space there are occasional short, interrupted, granulose striations of the same strength as the peristomes.

This species, under different conditions of preservation, varies much in appearance. When the frond is well preserved the apertures are indistinct, being obscured by the nodes, but when macerated, so that the nodes are obsolete, the apertures are very conspicuous; when still further macerated the vesicles are seen, appearing as angular pits between the cell apertures. The apertures are sometimes so arranged that the peristomes give to the surface a striated appearance.

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Formation and locality. Hamilton group, West Hamburg, Erie county, N. Y.

STICTOPORA INTERSTRIATA.

PLATE LXII, FIGS. 7-12.

Stictopora interstriata, HALL. Trans. Albany Institute, vol. x, p. 191. 1881.
" " " Report of State Geologist for 1883, p. 45. 1884.

ZOARIUM consisting of a flattened, dichotomously branched frond. Branches 2.50 mm. in width, with essentially parallel margins, scarcely enlarging before bifurcation; non-celluliferous marginal space .33 mm. wide; transverse section lenticular, angles very acute, greatest thickness observed .65 mm.; the bifurcations usually occur at intervals of from 10 to 20 mm., but on one specimen, which in all other respects is similar to the ordinary forms, they occur at intervals of 5 or 6 mm. Cells tubular, for the greater portion of their length recumbent, then turning abruptly and opening directly outward. Cell apertures oval, length about .30 mm., width a little more than one-half the length, disposed in longitudinal rows, the apertures being separated by one and one-half times their diameter the arrangement is indistinct; they often form irregular, transverse rows, the apertures of

the rows being nearly or quite in contant; on some fronds they are disposed in regular, oblique transverse rows, at an angle of about forty-five degrees to the axis of the branch. Peristomes thin, equally elevated, with several minute, spinuliform projections from the inner surface of the cell walls. Non-celluliferous margin and interapertural space with numerous, fine interrupted striæ, which very frequently have the appearance of elongate mesopores; height slightly less than that of the mesopores, from fifteen to eighteen in the space of 1 mm.

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Formation and locality. Hamilton group, Fall-brook, four miles from Canandaigua, Ontario county, N. Y.

Stictopora recubans, n. sp.

PLATE LXIII, FIGS. 20, 21.

Zoarium consisting of a flattened, dichotomously branched frond proceeding from a spreading base attached to other bodies; branches frequently curved, about 3 mm. wide, with margins essentially parallel; non-celluliferous marginal space flat, width a little more than .50 mm.; transverse section lenticular, at .50 mm. from the margin abruptly contracting and extremely thin, the remaining portion convex, the greatest thickness .50 mm.; bifurcations comparatively frequent, on the specimens observed occurring at intervals of 6 mm. or less. Cells tubular, those at the middle of the branch recumbent for one-half their length, then abruptly bending and opening directly outward; marginal cells recumbent for nearly their entire length. The central ranges of cells are parallel with the longitudinal axis, becoming more oblique as they recede, the marginal ones being at an angle of about forty-five degrees to the axis. The intercellular tissue consists of irregularly disposed vesicles. Cell apertures circular, frequently pustuliform, diameter about .12 mm., regularly disposed in longitudinal, nearly parallel rows; six or seven rows on a branch, separated by about twice the diameter of an aperture; the marginal apertures are slightly larger than the others, and a portion of the cell walls is often exposed for more than half of its entire length. Peri-

stomes thin, equally elevated, not denticulated. Ranges of apertures near the middle of the branch separated by a smooth, narrow ridge. When seven ranges of apertures occur the ridges nearest the middle of the branch are more prominent than the others; when six ranges, the central ridge is the most prominent, sometimes having the appearance of a carina, the two outer ranges of each margin are not separated by ridges.

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Formation and locality. Hamilton group, shores of Seneca lake, Seneca county, N. Y.

STICTOPORA SUBCARINATA.

PLATE LXIII, FIGS. 1-6.

Stictopora? subcarinata, HALL. Trans. Albany Institute, vol. x, p. 191. 1881.
" *(s. g. ?) dichotoma*, HALL. By error. Report of State Geologist for 1883, p. 48. 1884.

ZOARIUM consisting of a flattened, dichotomously branched frond, arising from a spreading base, or from several rootlets attached to foreign bodies; distal extremities obtusely angular; for a few mm. above the base the stipe is slender, width less than 1 mm., having only two or three ranges of cell apertures; the frond then somewhat abruptly widens and becomes more flattened; branches above a bifurcation about 2 mm. wide, very gradually and regularly increasing to 2.50 mm. before bifurcating; non-celluliferous marginal space a little less than .50 mm. wide; margins sometimes crenulate; transverse section lenticular, abruptly contracting and very thin near the margins, the intermediate portion convex or sub-angular; bifurcations on the specimens observed occurring at intervals of from 4 to 10 mm.; branches diverging at an angle of about forty-five degrees. Cells tubular, for a portion of their length recumbent, then abruptly curving and opening directly or obliquely outward; the cells at the middle of the branch have a direction parallel with the longitudinal axis, becoming more and more oblique as they approach the margin, where they are occasionally nearly rectangular to the axis. The intercellular tissue consists of irregularly disposed vesicles. Cell apertures oval, arranged in essentially parallel, longitudinal rows, and very frequently in oblique, ascending rows from the

middle of the branch. The apertures of the central ranges are minute, circular, sixteen in the space of 5 mm., diameter .18 mm. or less; peristomes strong, equally elevated; marginal apertures oval, length .25 mm., width two-thirds the length, ten in the space of 5 mm.; posterior portion of peristomes the more strongly elevated; frequently the central ranges are the smallest, each succeeding range increasing in size; usually six or seven rows of apertures on a branch; generally there are three ridges on each branch separating the rows of apertures, the central ridge being the most prominent and often having the appearance of a carina; the two outer ranges of apertures on each margin of a branch are seldom, if ever, separated by ridges.

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Formation and localities. Hamilton group, two and one-half miles east of Alden Station, Erie county; Bellona, Yates county, and York, Livingston county, N. Y.

SEMIOPORA, Hall. 1881.

Semiopora bistigmata.

PLATE LXII, FIGS. 27-29.

Semiopora bistigmata, Hall. Trans. Albany Institute, vol. x, p. 193. 1881.
" " " Report of State Geologist for 1883, p. 51. 1884.

Zoarium consisting of a flattened dichotomously branched frond, proceeding from a spreading base attached to foreign bodies. Branches a little less than 2 mm. in width; margins parallel, not expanding before bifurcation; non-celluliferous marginal space extremely narrow; transverse section abruptly narrowing and very thin near the margins, obscurely sub-angular at the middle, greatest thickness a little less than .15 mm.; bifurcations comparatively distant on the specimens observed, occurring at intervals usually of from 10 to 20 mm.; branches diverging at an angle of about thirty degrees; in one instance a branch trifurcates. Cells tubular, oblique, gradually enlarging to the aperture. The intercellular tissue consists of irregularly disposed vesicles. Cell apertures oval, sometimes nearly circular, length about 22 mm., width usually two-thirds, but sometimes four-fifths the length;

regularly disposed in parallel longitudinal rows, eight rows on each face of the branch; the apertures of the marginal rows are larger than the others, having a length of .30 mm., and are oblique to the axis of the branch. Peristomes thin, slightly and equally elevated, not denticulated, and when well preserved granulose. Between adjacent cell apertures, in a longitudinal direction, are two minute pits, arranged laterally, partitions very slightly elevated; in the course of growth these pits form minute tubuli between the cell tubes. The peristomes are laterally wholly or partially in contact, according as the apertures are opposite or alternate, and coalesce, giving to the ranges of apertures the appearance of being separated by comparatively prominent granulose ridges.

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Formation and locality. Hamilton group, West Williams, Ontario, Canada.

TÆNIOPORA, Nicholson. 1874.

Tæniopora exigua.

PLATE LXII, FIGS. 15-26.

Tæniopora exigua, Nicholson. Palæontology of Ontario, p. 108. 1874.
" " Hall. Trans. Albany Institute, vol. x, p. 192. 1881.
Pteropora dwogeneris, Hall. Trans. Albany Institute, vol. x, p. 192. 1881.
Tæniopora exigua, Hall. Report of State Geologist for 1883, p. 49. 1884.

Zoarium ramose, flattened, proceeding from a spreading base, or from rootlets attached to foreign bodies; branches triangular or flattened. The branches of the lower portion of the frond are usually triangular, although this condition may occur on all portions of the frond, sides concave, equal or nearly so, width 3 mm. or a little more; from each angle proceed depressed quadrangular branches, which both bifurcate and ramify laterally, continuing growth in the same manner as the parent branches; the flattened branches are from a little less than 3 mm. to 4 mm. wide, with parallel margins, not expanding before bifurcation; non-celluliferous marginal space flat, smooth, width from .33 to .50 mm.; transverse section rhomboidal, sometimes abruptly contracted near the margin, angular at the middle, with a prominent

sharp elevation; greatest thickness, without the elevation, from .50 to .75 mm.; bifurcations on the specimens observed occur at intervals of from 15 to 30 mm.; lateral branches very frequent, occurring usually at intervals of from 5 to 8 mm.; lateral branching and bifurcation sometimes occur together giving to the branch a trifurcating appearance; the branches usually diverge at an angle of about forty-five degrees. Cells tubular, cylindrical, gradually enlarging to the apertures; in the triangular branches they proceed from laminæ which radiate from the center to each angle of the branch; in the flattened branches they proceed from the mesotheca, and are recumbent for about one-half their length, then abruptly turning and generally opening directly outward (pl. lxii, fig. 18); at the center of the branch their direction is parallel to the axis of the frond, each succeeding row of cells becoming more and more divergent until frequently the marginal cells are nearly rectangular to the axis (pl. lxii, fig. 19). Intercellular tissue vesiculose; near the base the vesicles are large, smaller and more compactly disposed near the surface. Cell apertures disposed in longitudinal parallel rows, and very frequently in oblique ascending rows, from the middle of the branch; usually six or eight longitudinal rows on each face of the branch; the apertures of the central rows are minute, circular, with a diameter of about .12 mm., sixteen in the space of 5 mm.; marginal apertures sometimes circular, diameter .25 mm., at other times oval, length .30 mm., width two-thirds the length, ten in the space of 5 mm.; sometimes the apertures, with the exception of those of the marginal rows, are of the same size; at other times those of the central range are the smallest, those of each succeeding range being a little larger; on some fronds the apertures are distinctly papilliform. There is often a prominent, angular carina along the middle of the flattened branch, which has a height of from .50 to .75 mm., and a width at the base of .25 mm., generally straight, but sometimes a little sinuous; the sides of the triangular branches are concave and have no ridges or carina. Usually there are not more than eight ranges of apertures, and forms occur having only four ranges, while others have ten, but as all intermediate gradations occur, no specific distinction can be based upon this character; there is also considerable variation in the strength of the carina.

This is one of the most common and characteristic species and will be readily distinguished from any other form. The triangular branches, with their alate marginal extensions, present so different an aspect from the ordinary flattened forms of this species that the name PTEROPORA was suggested for them. In this direction also these forms approach PRISMOPORA, and it may yet be found desirable to unite the different modifications under one generic term.

Formation and localities. Hamilton group, Montieth's Point, Ontario county; Bellona, Yates county; West Hamburg, Erie county; Unadilla Forks; Borodino, Onondaga county; near the head of Canandaigua lake; near Arkona, Bosanquet Township, Ontario, Canada, and numerous other localities.

PRISMOPORA, HALL. 1881.

(See page 97.)

PRISMOPORA DILATATA.

PLATE LXII, FIGS. 13, 14.

Prismopora dilatata, HALL. Trans. Albany Institute, vol. x, p. 193. 1881.
" " " Report of State Geologist for 1883, p. 50. 1884.

ZOARIUM ramose, proceeding from a spreading base, which for the space of a few mm. above is nearly cylindrical, with a diameter of about 3 mm., then rapidly expanding; the frond is apparently bifurcated and also laterally branched; branches generally triangular, sides unequal, two of them very concave, sub-angular, the other much less concave; on one branch measured the width of each of two sides is 3 mm., of the third side 5 mm.; some of the branches are larger than this, and others smaller, but generally preserving about the same proportions; margins slightly diverging; non-celluliferous marginal space about .50 mm. in width; below each bifurcation and at the angles formed by two branches there is an elongate, triangular space 1 mm. wide and 3 mm. long, destitute of cell apertures; bifurcation and lateral branching frequent, occurring at intervals of from 8 to 10 mm.; the lateral branches are both alternating and opposite. Cells tubular, arising from mesial plates, which radiate from the center to each angle of the branch. Intercellular tissue composed of irregularly disposed vesicles. Cell

apertures circular or very broadly oval, diameter .35 mm.; irregularly and very closely disposed, usually very nearly or quite in contact. Peristomes strong, generally equally elevated, but sometimes the posterior portion is the more prominent.

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Formation and locality. Hamilton group, near Leonardsville, Madison county, New York.

Prismopora lata.

NOT FIGURED.

Zoarium consisting of a dichotomously branched frond, arising from a spreading base attached to foreign bodies; branches triangular, two of the sides of equal width, the third wider; on the specimens observed the two equal faces of a branch have a width of 6 mm. each, the other 9 mm.; the other branches of the same frond are somewhat smaller; margins of each face essentially parallel, the branches scarcely increasing in size before bifurcation: non-celluliferous marginal space comparatively broad, width nearly .75 mm.; there are also, at more or less regular intervals along the margin, obtusely triangular areas, destitute of cell apertures, having a width of about 3.50 mm., and a depth of nearly 2 mm.; sometimes these areas are continuous; bifurcations comparatively infrequent on the specimens observed, occurring at intervals of .20 mm. or more; branches diverging at an angle of about sixty degrees. Cells tubular, cylindrical, arising from mesial laminæ, which radiate from the center to each angle of the branch. Along the middle of the branch the cells have a direction parallel with the axis, becoming more and more oblique as they recede until the marginal cells are sometimes nearly rectangular to the axis; septa very infrequent or obsolete. Intercellular tissue vesiculose; vesicles more compactly disposed near the surface than at the center of the branch. Cell apertures trilobate, pustuliform, length about .20 mm., width from one-half to two-thirds the length; near the middle of a face of the branch they are disposed in somewhat irregular, longitudinal rows, but over the greater portion of the face in more or less regular, oblique, ascending rows, which are distant nearly twice the

length of an aperture; the apertures forming the rows are closely disposed, the pustules being in contact and giving to the apertures the appearance of being situated on curved elevations or ridges. The marginal apertures are a little larger than the others, having a length of about .25 mm. Peristomes thin, the posterior portion a little the more prominent and having two slight denticulations. There are no longitudinal striations on the specimens observed.

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Formation and locality. Hamilton group, Hill's gulch, four miles south of Le Roy, New York.

ACROGENIA, HALL. 1881.

ACROGENIA PROLIFERA.

PLATE LXIII, FIGS. 7-15.

Acrogenia prolifera, HALL. Trans. Albany Institute, vol. x, p. 194. 1881.
" " " Report of State Geologist for 1883, p. 52. 1884.

ZOARIUM ramose, branches flattened, proliferous. One frond, which is very well preserved, has the following manner of growth: the basal extremity for the space of 5 mm. is simple, with several lateral rootlets; it is strongly striated, and has a diameter of about 1.25 mm.; this portion bifurcates, the two parts very gradually diverge and have frequent lateral striated rootlets, the striæ somewhat spirally disposed; the ends are conically truncated; from these truncated ends proceed two short growths, both extremities of which are conically truncated; from the apices of these proceeds a striated, cylindrical stipe, conically truncated at each end, and having a length of 8 mm., and a diameter of 2 mm.; the striæ are of unequal strength, some of them extremely fine: from the truncated apex of this stipe proceed apparently several branches with conically truncated bases which are at first cylindrical, becoming flattened and very gradually expanding: from this point the growth is regular, two depressed, quadrangular branches proceeding from the truncated extremity of each preceding branch; length of internodes

varying from 10 to 15 mm., width near the base about 1.50 mm., very gradually enlarging to 3.50 mm.; on some fronds the branch is flattened immediately above the truncated base and the surface has the same appearance as above; on others the lower portion is cylindrical and striated, gradually becoming flattened; the striæ on different branches vary in appearance; on one branch the striations continuing for the space of 8 mm., about fifteen in the space of 5 mm. measured transversely, a few of the striæ being much stronger than the others; the contiguous branch has the lower portion for the space of 5 mm., striated, but a portion of the striæ become comparatively strong rounded ridges, seven ridges in the width of the branch; another branch has the rounded, finely striated ridges similar to the preceding, but between them are cell apertures which continue to the truncate base; these variations occur on the same frond. Non-celluliferous marginal space extremely narrow: transverse sections of a branch, for the greater portion of its length, are lenticular, obtusely angular at the middle, greatest thickness observed about .65 mm.; branches diverge at an angle of from thirty to forty-five degrees. Cells tubular, recumbent for a portion of their length, then abruptly curving and opening directly outward, gradually enlarging to the aperture. Intercellular tissue vesiculose, vesicles irregularly disposed. Cell apertures oval, width usually a little more than one-half the length, arranged in nearly parallel longitudinal rows, from eight to twelve rows on each face of the branch; the apertures of the marginal rows are slightly larger and more distant than the others, .33 mm. in length, eight or nine in the space of 5 mm.; on the central ranges the length is .25 mm., and there are fifteen in the same space. Peristomes very slight, posterior portion with a prominent projection, the extremities of which form two denticulations; the peristomes are often indistinct, and the denticulations are so extended as to give the appearance of minute, circular cell apertures or of a succession of loops. Ranges of apertures separated by continuous ridges, sometimes narrow, angular, and smooth, at other times broader, more prominent and finely striated, the central ridge is always the strongest and has the appearance of a carina.

This species is very characteristic and can be easily distinguished from any other at present known, in this horizon, by the peculiar manner of growth. A fragment of a branch, where the base is not preserved, somewhat resembles *Stictopora subcarinata*, but the branches are wider, the ridges separating the rows of apertures are stronger, the central ridge is much more conspicuous, the marginal cell apertures are smaller and the marginal non-celluliferous space is narrower.

Formation and localities. Hamilton group, Black Point, Canandaigua lake; Bellona, Yates county; Lodi Landing, Seneca Lake, and Darien Centre, Genesee county, N. Y.

STICTOPORINA, nov. sub. gen.

STICTOPORA (STICTOPORINA) CLAVIFORMIS.

NOT FIGURED.

Trematopora claviformis, HALL. Trans. Albany Institute, vol x, p. 181. 1881.
" " " Report of State Geologist for 1883, p. 12. 1884.

ZOARIUM consisting of an erect frond of 8 to 10 mm. in height; base obtusely pointed, and for a short distance above the frond is cylindrical, diameter about .80 mm., gradually enlarging and becoming flattened; width above a bifurcation a little more than 1 mm., increasing to 2 mm.; no non-celluliferous marginal space; transverse section broadly lenticular or flattened oval, greatest thickness observed about .80 mm. The first bifurcation occurs at 5 mm. above the base, the others at intervals of 3 mm.; on the specimens observed there are not more than three bifurcations, and this number occurs on one specimen only. Cells tubular, arising obliquely from a mesotheca. Cell apertures oval, length about .25 mm., width two-thirds the length, disposed in more or less regular oblique transverse rows, at an angle of about forty-five degrees to the axis of the branch, separated by about one-third the width of an aperture. Peristomes obsolete. Interapertural space elevated, angulated, enclosing the apertures in a rhomboidal or polygonal area. The crest of the elevation is marked by a row of very minute granules and at the angles by a more prominent node.

The surface characters are somewhat similar to those of *Stictopora rhomboidea* of the Upper Helderberg group, but the manner of growth will readily serve to distinguish it. From all other species, at present known, it may be distinguished by the clavate form of the frond.

Formation and locality. Hamilton group, Kashong creek, Bellona, Yates county, N. Y.

PTILODICTYA, Lonsdale. 1839.

(See page 38.)

Ptilodictya parallela, n. sp.

PLATE LXI, FIGS. 7, 8.

Zoarium consisting of a simple stipe, having an acute base, transverse section near the base circular, striated, rapidly enlarging and becoming flattened above; stipe about 3 mm. in width, the margins for the greater portion of the length essentially parallel; transverse section lenticular, greatest thickness about .50 mm. Cells tubular, arising obliquely from the mesotheca, curving and opening directly outward; the marginal cells are slightly oblique to the axis of the frond, the others are parallel. The intercellular tissue has not been observed. Cell apertures circular, diameter about .20 mm., disposed in longitudinal parallel rows, from ten to twelve on a branch, the apertures of the rows are separated by a little less than their diameter; in the central rows there are sixteen apertures in the space of 5 mm.; in the marginal rows twelve in the same space. Peristomes thin, slightly elevated, the posterior portion the most prominent, and with two minute denticulations. Ranges of apertures separated by smooth prominent ridges, about one-third the width of the cell apertures; the ridge along the middle of the branch is stronger than the others and sometimes has the appearance of a carina.

Formation and localities. Hamilton group, Darien Centre, Genesee county, and near the head of Canandaigua lake, Ontario county, N. Y.

Ptilodictya plumea, n. sp.

PLATE LXI, FIGS. 9-12.

Zoarium consisting of a flattened stipe, base conically truncated, distal extremity of frond rounded. One well-preserved frond, immediately above the truncated basal apex, is cylindrical, having a diameter of 1 mm., very gradually enlarging and becoming flattened for the distance of 6 mm., where it expands much more rapidly and becomes very thin; at a point 7 mm. above the base the frond is 17 mm. in width, above that point the margins are sub-parallel, the frond very slightly expanding; on other examples the margins are parallel and the frond continues of uniform width; transverse section flattened-lenticular, greatest thickness .30 mm.; non-celluliferous marginal space obsolete. Cells tubular, oblique for the greater portion of their length, but usually opening directly outward. The cylindrical basal portion of the frond is striated; striæ conspicuous, sharp, interrupted, granulose. Cell apertures circular or broadly oval, immersed, diameter about .18 mm., separated by from one-third to one-half the diameter of an aperture, generally irregularly disposed, but sometimes forming sub-regular intersecting rows oblique to the axis of the frond. Near the margins the cell apertures are oblique to the axis and present a confused appearance. Peristomes obsolete. Interapertural space elevated, convex or angulated, granulose, usually only one series of granules between adjacent apertures, but occasionally two, sometimes, where the apertures are disposed in intersecting rows there are more prominent nodes at the angles of the interapertural ridges. The surface is marked by low convex monticules, the centers of which are distant about 2 mm.; the apertures on these are a little larger than the others, and sometimes present a slightly confused arrangement.

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Formation and locality. Hamburg-on-the-Lake, Erie county, N. Y.

Ptilodictya retiformis, n. sp.

PLATE LXI, FIG. 13.

This species, in its manner of growth and general appearance, is very similar to *P. plumea*, but the cell apertures are more nearly oval, and more closely disposed. The interapertural space is angular, minutely granulose, and with a prominent node at each cell angle. The surface is not marked by maculæ or monticules. It may be distinguished from *P. scutulata*, which it closely resembles in its surface characters, by its much wider frond.

Formation and locality. Hamilton group, Alden, Erie county, N. Y.

Ptilodictya scutulata.

NOT FIGURED.

Stictopora? scutulata, Hall. Trans. Albany Institute, vol. x, p. 191. 1881.
" " " Report of State Geologist for 1883, p. 47. 1884.

Zoarium consisting of a flattened frond, width from 1.50 to 2.50 mm.; without non-celluliferous marginal space. Transverse section lenticular, greatest thickness .25 mm.; marginal angles not acute. Cells tubular, arising from a mesotheca. Cell apertures oval, length .20 mm., width two-thirds the length, closely disposed, nearly in contact, sometimes irregularly disposed, at other times forming oblique intersecting rows. The interapertural space is elevated, angulated, having a line of minute nodes or granules, and frequently more prominent nodes at the angles. The surface presents a reticulated appearance.

Since no bifurcations have been observed, and as specimens more than 20 mm. in length occur without branches, it seems sufficient evidence to remove it from Stictopora to which it was originally referred. The cell apertures resemble those of *Ptilodictya retiformis*, but the species may be distinguished by its much narrower form. It has precisely the appearance of a flattened frond of some specie, of Orthopora, but the mesotheca and manner of growth of the cell tubes show its alliance with Ptilodictya.

Formation and locality. Hamilton group, near the head of Canandaigua lake, Ontario county, N. Y.

GLAUCONOME, Goldfuss. 1826.

(See page 101.)

Glauconome carinata.

PLATE LXVI, FIGS. 23, 24.

Glauconome carinata, Hall Trans. Albany Institute, vol. x, p. 196. 1881.
" " " Report of State Geologist for 1883, p. 60. 1884.

Zoarium consisting of a midrib or rachis proceeding from a spreading base, attached to foreign bodies, and having slender, equidistant, lateral branches, which preserve the same manner of growth as the primary rachis; celluliferous on one face only; midrib from .30 to .35 mm. in width; transverse section broadly sub-cuneiform; the non-celluliferous face flattened, and with three prominent ridges, one at each margin and one along the middle, sometimes equally elevated, at other times the central one is the strongest and has the appearance of a carina. The lateral branches have a width of about .18 mm., and are regularly distant from each other between two and three times the width of a branch, very nearly on a plane with the rachis, flattened and with a slender striation along the middle, sometimes minutely granulose. On the celluliferous face the midrib and branches are sub-angular. Cell apertures circular, in two ranges, one on each side of the midrib and branches, opening almost directly outward, separated by from once and one-half to twice the diameter of an aperture, fifteen in the space of 5 mm. Peristomes comparatively strong, equally elevated. Lateral branches depressed below the cell apertures of the midrib. Ranges of apertures separated by comparatively prominent carinæ, the midrib being much the strongest.

Numerous fragments of this species have been observed, it being not uncommon; on all the specimens the lateral branches are very short, the length not exceeding .50 mm., and very frequently less. This species may be distinguished from any other, at present known, by its small size and the three comparatively prominent striæ or ridges on the non-cellulifer ous flattened face of the rachis.

Formation and localities. Hamilton group, Eighteen-mile creek, Erie county; Lodi Landing, Seneca lake, and near the head of Canandaigua lake, Ontario county, N. Y.

THAMNISCUS, King. 1849.

(See pages 41 and 104.)

Thamniscus pauciramus.

NOT FIGURED.

Thamniscus pauciramus, Hall. Trans. Albany Institute, vol. x, p. 197. 1881.
" " " Report of State Geologist for 1883, p. 60. 1884.

Zoarium fruticose, several stems arising from a common base, bifurcating and laterally branched, celluliferous on one face; branches occurring at intervals of from 2.50 to 7 mm., diverging at an angle of about forty-five degrees; just above a bifurcation a little less than .50 mm. in width, very gradually increasing to .60 mm., sometimes of essentially the same size for nearly their entire length. On the non-celluliferous face the branches are gently convex, striated, from three to five striations on a branch, minutely granulose. Cell apertures oblique, circular, or sub-polygonal from mutual pressure, irregularly and very closely disposed, usually in contact.

* * * * * * * * *

Formation and locality. Hamilton group, Monteith's Point, west shore of Canandaigua lake, Ontario county, N. Y.

REPTARIA, Rolle. 1851.*

Reptaria stolonifera.

PLATE LXV, FIGS. 17-19.

Reptaria stolonifera, Rolle. Leonhard & Bronn. Neues Jahrbuch, p. 810, pl. ix, figs. 5, 6. 1851.
Ptilionella penniformis, Hall. Trans. Albany Institute, vol. x, p. 195. 1881.
" " " Report of State Geologist for 1883, p. 56. 1884.

Zoarium parasitic procumbent, attached for its entire extent; consisting of a rachis, from which proceed laterally, at regular intervals, simple cell tubes, and, at irregular distances, tubes which have the same manner of growth as

* I am indebted to Mr. John M. Clarke for calling my attention to this genus, published in a work which has not been accessible to me.

the primary rachis; this mode of growth is continued indefinitely, the fronds covering a comparatively large area. Cell tubes sub-cylindrical, sinuous, especially near the base, the attached portion flat, the free portion convex; length about 2 mm., width .50 mm., turning abruptly outward at the extremities, the apertures being parallel with the axis of the branch and broadly oval, generally alternating, occurring at intervals of about 1.33 mm.; for a short distance they are nearly parallel with the rachis, then diverging at an angle of from thirty-five to forty degrees, margins of the branches in contact, but not coalescing, the end of each succeeding cell tube projecting beyond the previous one, giving a serrated appearance to the margins of the frond. In well-preserved specimens the cell tubes are strongly annulated and generally obscurely angular along the middle, giving the annulations the appearance of a row of nodes; on some portions of the frond the cells are not angular, but the annulations still have somewhat the appearance of nodes along the middle of the tube; the annulations are broad, abruptly rounded, three in the space of 1 mm., with indications of faint longitudinal striations.

This species forms comparatively large fronds, fragments occurring nearly 100 mm. in length; numerous branches apparently originate at a common base; on different fronds and on different portions of the same there is a great irregularity in the frequency of branching; on one specimen there are five widely diverging branches in the space of 60 mm.; on another frond in the same space there are fourteen branches, diverging at an angle of thirty degrees, on one portion three branches in the space of 7 mm. The branch becomes gradually narrower toward the extremity, the last cell being terminal and extending beyond all the others. All the specimens observed occur upon the shells or casts of Cephalopoda.

This species may be distinguished from *R. nodata* by the narrower cell tubes, and the much less prominent annulations and nodes; from *Hederella conferta* by the difference in the character of the rachis, the more regular arrangement of the cell tubes, and the prominent annulations.

Formation and locality. Hamilton group, Cazenovia, Madison county, N. Y.

Reptaria nodata.

NOT FIGURED.

Ptilionella nodata, Hall. Trans. Albany Institute, vol. x, p. 195. 1881.
" " " Report of State Geologist for 1883, p. 57. 1884.

Zoarium incrusting or free, procumbent, ramose, consisting of a rachis, from which proceed lateral tubular cells, and at irregular distances branches or tubules, which have the same manner of growth as the primary rachis; angle of divergence from fifteen to ninety degrees. Cell tubes sub-cylindrical, more or less angular, transverse section depressed-oval, length from 3 to 3 50 mm., width a little less than .60 mm., near the extremity turning abruptly outward; generally alternating, occurring at intervals of a little more than 1 mm. on each side of the rachis, and diverging from it at an angle of about thirty-five degrees; in contact for nearly their entire length, frequently overlapping and having the appearance of coalescing; each succeeding cell projects about .50 mm. beyond the preceding one, giving to the margin of the frond a serrated appearance; apertures parallel with the axis of the branch, not elevated above the surface, broadly oval, width about three-fourths the length.

The cell tubes are strongly annulated or nodose; sometimes the annulations extend entirely across the tube, but frequently there is a line of strong nodes along the middle, and others on the margins; on account of the overlapping of the tubes the marginal nodes are often in contact with the central line of nodes of the succeeding cells, coalescing with them, and giving to the cells the appearance of being connected by lateral processes; there are about four annulations or nodes in the space of 1.50 mm., and also fine undulating striæ, which have the appearance of being continuous from one cell to another. On account of the overlapping of the cells the angularity is obscure, and upon cursory examination they often appear flat, with two rows of prominent nodes, one on each margin.

This species may be distinguished from *Reptaria stolonifera* by the larger cells, wider frond, and much more prominent nodes: from *Hederella conferta* by the different appearance of the rachis, the angular cell tubes, and the prominent annulations and lines of nodes.

Formation and localities. Hamilton group, Hopeton, shore of Seneca lake, Yates county, and in the Genesee Valley, Livingston county, N. Y.

HEDERELLA, HALL. 1881.

HEDERELLA CIRRHOSA.

PLATE LXV, FIGS. 12, 13.

Hederella cirrhosa, HALL. Trans. Albany Institute, vol. x, p. 194. 1881.
" " " Report of State Geologist for 1883, p. 53. 1884.

ZOARIUM consisting of a filiform, tubular axis, from which proceed laterally simple tubular cells, and at irregular intervals other tublues having the same manner of growth as the main axis; parasitic, procumbent, attached for its entire length, occurring on Cyathophylloid corals, Brachiopoda and Crinoid columns. Cells about 1 mm. in length; diameter .20 mm.; transverse section nearly circular, turning abruptly outward at the extremity, the aperture being parallel with the axis of the branch and circular, generally alternating, distant on the same side of the branch from 2 to 2.50 mm., though sometimes occurring at irregular intervals. Surface marked by transverse striæ and angular annulations.

This species may be easily distinguished from others of this genus by its much more slender, filiform character.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

HEDERELLA CANADENSIS.

PLATE LXV, FIGS. 1-8, 14 and 16?

Alecto? Canadensis, NICHOLSON. Canadian Naturalist, vol. vii, No. 3. 1874.
Aulopora? Canadensis, NICHOLSON. Pal. Prov. of Ontario. 1874.
Hederella " HALL. Trans. Albany Institute, vol. x, p, 194. 1881.
" " " Report of State Geologist for 1883, p. 53. 1884.

ZOARIUM parasitic, procumbent, attached for its entire length; usually occurring on Corals or Brachiopoda, most frequently on *Heliophyllum Halli*. It consists of a primary cylindrical, tubular axis, which has lateral tubular cells at frequent intervals, and occasionally cells having the same manner of growth as the primary axis. This mode of growth is indefinitely continued so that large

surfaces are covered by the zoarium. The cell tubes are sub-cylindrical, at first rapidly expanding, but for the greater portion of their length the margins are parallel; transverse section oval in outline, length from 1.25 to 2 mm., diameter .33 mm., generally arranged in alternating order, and often regularly distant, on the same side of the branch 1.50 mm.; the angle of divergence from the axial tube is sometimes equal to forty-five degrees, at other times they are in contact with the axis for nearly their entire length, turning abruptly outward near the end, the apertures being parallel with the axis of of the branch and a little constricted; during the process of growth the apertures are rectangular to the axis. Surface marked by numerous, strong, transverse striæ, with finer striations between, and frequently the stronger striæ have the appearance of prominent annulations; the cell tubes vary in their surface characters, some of them having only the prominent annulations, others only the fine striæ, while still others have both the annulations and finer striations, and when well preserved they have also numerous, very fine longitudinal striæ.

This species is intermediate in size between *Hederella cirrhosa* and *Hederella filiformis;* from the former it is easily distinguished by the greater size of the cell tubes and the coarser appearance of the frond; from the latter it may be distinguished by the smaller diameter and greater length of the cell tubes, the cells of that species being more than .50 mm. in diameter, and seldom having a length of more than 1.25 mm.; the frond of this species is also much less compact in appearance: from *H. magna* it is distinguished by the much smaller size of the cell tubes, those of that species having a diameter of more than 1 mm.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

Hederella filiformis.

PLATE LXV, FIGS. 9–11.

Aulopora filiformis, Billings. Canadian Journal, New Series, vol. 4, p. 119. 1859.
Hederella " Hall. Trans. Albany Institute, vol. x. p. 194. 1881.
" " " Report of State Geologist for 1883, p. 54. 1884.

Zoarium parasitic, procumbent, attached for its entire length, consisting of an elongated, sub-cylindrical primary axis, from which proceed, laterally, simple

tubular cells, and occasionally tubular extensions having the same manner of growth as the primary axis. Fronds comparatively large, some specimens entirely cover the exterior of Cyathophylloid corals, which have a length of 75 mm., and a diameter at the calix of 45 mm. Axial tube and lateral cells sinuous or tortuous, diameter a little more than .50 mm.; length of cells generally from 1 to 1.25 mm.; just before ceasing growth the cell tubes turn abruptly outward, the apertures being parallel with the axis of the branch and constricted, the width a little more than one-half the length. Cell tubes sometimes alternating, at other times occurring opposite to each other, rapidly expanding for a short distance, but for the greater portion of their length essentially of the same size; those on the same side of the axial tube are quite regularly distant from each other 1.50 mm. One side of the cell for its entire length is very frequently in contact with the axial tube and the base of the succeeding cell tube, the frond presenting a compact appearance, but others diverge at an angle of forty-five degrees. The axial tubes and lateral cells are sharply striated and wrinkled transversely, and when well preserved have numerous, very fine, longitudinal striations; on some cells there are evidences of a line of nodes along the middle.

This species may be easily distinguished from *Hederella cirrhosa* by the much larger size of the cell tubes, those of that species having a diameter of only .20 mm., and a proportionally closer arrangement; it is intermediate in size between *H. Canadensis* and *H. magna;* from the former it may be distinguished by the greater diameter and lesser length of the cell tubes, and from the latter by its more slender form and less compact appearance.

Formation and localities. Hamilton group, York, Livingston county; near Canandaigua lake, Ontario county, N. Y., and near Arkona, township of Bosanquet, Ontario, Canada.

Hederella conferta.

NOT FIGURED.

Ptilionella conferta, Hall. Trans. Albany Institute, vol. x, p. 195. 1881.
" " " Report of State Geologist for 1883, p. 56. 1884.

Zoarium parasitic, usually occurring on Cyathophylloid corals, most frequently on *Heliophyllum Halli;* procumbent, attached for its entire extent; con-

sisting of a main tube or axis from which proceed laterally, at more or less regular intervals, simple tubular cells, and at irregular distances other tubular extensions which have the same manner of growth as the primary axis. This mode of growth is indefinitely continued, so that comparatively large surfaces are covered by the fronds. The cell tubes are sub-cylindrical, transverse section broadly oval, length from 2 to 2.50 mm., diameter .50 mm., turning abruptly outward at the extremity, the apertures opening on a line parallel with the axis of the branch and very broadly oval or nearly circular. Cells generally alternating, distant on the same side of the main axis from 1 to 1.25 mm.; the angle of divergence from the axial tube is usually from thirty-five to forty degrees. Surface marked by numerous, very fine, sharp, transverse striations, and nearly equally fine longitudinal striæ, often presenting a minutely cancellated appearance; on many of the cell tubes there are also more prominent annulations and wrinkles.

On account of the frequent occurrence of the cell tubes, their margins are in contact for their entire length, the frond presenting a much more compact appearance than usual in species of this genus and frequently so closely resembling the genus REPTARIA, that it is sometimes difficult to distinguish its generic relations.

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Formation and locality. Hamilton group, Darien Centre, Genesee county, N. Y.

HEDERELLA MAGNA.

PLATE LXV, FIG. 15.

Hederella magna, HALL. Trans. Albany Institute, vol. x, p. 195. 1881.
" " " Report of State Geologist for 1883, p. 55. 1884.

ZOARIUM parasitic, usually occuring on Cyathophylloid corals, most frequently on *Heliophyllum Halli;* procumbent, attached for its entire length, consisting of an axial tube from which proceed lateral, simple, tubular cells, and at infrequent intervals tubular extensions having the same manner of growth as the primary axis; length of cell tubes from 2 to 3 mm, diameter a little more than 1 mm., transverse section broadly oval; at first rapidly expand-

ing, afterward continuing of essentially the same width, bending abruptly outward near the extremity, the apertures being nearly circular, and having their margins parallel with the axis; during the growth the margin is rectangular to the axis. Cells generally alternating, but sometimes occurring irregularly, very often regularly distant on the same side of the branch about 2 mm. Surface marked by extremely fine, transverse striæ, and frequently by strong annulations, which are more prominent on some tubes than on others, and sometimes are entirely wanting; the fine striations invariably occur, and there are faint indications of longitudinal striæ. The angle of divergence of the cell tubes from the axial tube is variable, sometimes being forty degrees, at other times the cells are parallel with and partially cover the primary axis, overlapping each other; in this condition the axial tube is obscured, and the frond has somewhat the appearance of consisting of two parallel lines of cell tubes with the apertures opening outward.

This species can be distinguished from other forms of this genus by its much larger size.

Formation and locality. Hamilton group, York, Livingston county, N. Y.

HERNODIA, Hall. 1881.

Hernodia humifusa.

PLATE LXV, FIGS. 20, 21.

Hernodia humifusa, Hall. Trans. Albany Institute, vol. x, p. 196. 1881.
" " " Report of State Geologist for 1883, p. 58. 1884.

Zoarium parasitic, procumbent, consisting of tubular cells; increasing by lateral gemmation; from one to three buds from each cell. The cells have a length of 5 mm., gradually enlarging to the aperture, diameter at the smaller end .35 mm., the greatest diameter of 1 mm., is at .50 mm. from the aperture. Apertures slightly constricted, not elevated, rectangular to the axis of the cell on the specimens observed; transverse section sub-circular; attached surface flattened, upper surface convex. After budding the parent cell continues its growth frequently for the extent of 1.50 mm. or even more.

Surface marked by comparatively strong annulations, concentric and fine longitudinal striæ.

This form, in being parasitic, procumbent and increasing by gemmation, resembles the genus *Aulopora*, but the budding is always lateral, the young cells, for some distance, are in contact and frequently coalescing, with the parent cell; the gemmation is more irregular and occurs nearer the base.

Formation and locality. Hamilton group, Cazenovia, Madison county, N. Y.

BOTRYLLOPORA, Nicholson. 1874.

Botryllopora socialis.

PLATE LXIV, FIGS. 3, 4.

Botryllopora socialis, Nicholson. Geological Magazine. April, 1874.
" " " Pal. Province of Ontario, Canada. 1874.
" " Hall. Report of State Geologist for 1883, p. 61. 1884.

Zoarium consisting of small discoid bodies, occurring singly or in groups, connected by vesicular tissue, adherent to foreign bodies by their under surface which consists of a concentrically wrinkled epitheca: nearly all the specimens observed are parasitic on Cyathophylloid or Favositoid corals, sometimes occurring in groups of from seventy-five to a hundred zoaria; each one having a diameter of from 3.50 to 4 mm., convex, with a concave central area, which is somewhat variable in size, but usually from 1 to 1.50 mm. in diameter. Cells tubular, rectangular to the surface, disposed in double radiating rows, extending above the surface and forming prominent ridges about .30 mm. in width; adjacent ridges generally separated by a space about equal in width to that of a ray, but sometimes more closely disposed. Alternate ridges extend from the margin to the depressed central area, the others from one-half to two-thirds that distance. Cell apertures minute, circular, diameter .10 or .12 mm., in contact, often inosculating, having the appearance of being immersed. Each zoarium has from twenty to twenty-four rays, or from forty to forty-eight ranges of cells. Intercellular space vesiculose, vesicles comparatively large, and irregularly disposed.

The concave central space, lying between the ridges of apertures, and between the zoaria forming the colony, is bullate; the bullæ in the central space have a diameter of from .15 to .25 mm. and are polygonal; those between the ridges are much smaller, having a diameter of from .6 to .10 mm.; those between the individual zoaria are of two kinds, one circular or sub-polygonal from mutual pressure, the diameter generally from .50 to .60 mm., rarely a little more; these are very frequently in contact, and when separated the space between them is occupied by bullæ similar to those between the celluliferous ridges. When the surface becomes worn the upper walls of the bullæ or vesicles are worn or broken away, they have the appearance of shallow pits.

This genus is very similar to some forms of the genera RADIOPORA, or ACTINOPORA, of D'Orbigny. (Paléontologie Francaise; *Cretaceous Bryozoa.* Plates 644 and 649.)

Formation and localities. Hamilton group, Le Roy, N. Y., and West Williams, Ontario, Canada.

PTILOPORA, McCOY. 1849.

PTILOPORA STRIATA.

PLATE LXVI, FIGS. 30-33.

Ptilopora striata, HALL. Trans. Albany Institute. vol. x, p. 196. 1881.
" " " Report of State Geologist for 1883, p. 58. 1884.

ZOARIUM consisting of a strong stipe or midrib, proceeding from a spreading base, or from rootlets attached to foreign bodies, and having slender equidistant lateral branches, connected by slender processes or dissepiments; celluliferous on one face only. The base of the stipe has a width of 1.50 mm. or more, gradually tapering to .25 mm.; transverse section circular or broadly oval; lateral branches .25 mm. in width, uniform in size, diverging from the midrib at an angle of about forty-five degrees, regularly distant a little less than twice the width, seven in the space of 5 mm., transverse section broadly oval or circular.

On the non-celluliferous face the midrib and branches are rounded and striated; on the lateral branches the striæ are of uniform size, five or six

on each branch; on the midrib they are alternating, the smaller ones very fine, scarcely perceptible. Dissepiments very slender, width less than half that of the branches, rounded, finely striated, depressed below the plane of the branches and scarcely expanded at their junction, usually distant about 1 mm., but sometimes two occur very close together, not more than .20 mm. distant. On the celluliferous face the mibrib is of about the same convexity as on the opposite side; the lateral branches are more abruptly convex, the midrib striated, striations similar to those of the opposite face. Cell apertures in two ranges, those on the midrib oval, opening laterally, so that looking directly upon the surface they can scarcely be distinguished; separated by less than the length of an aperture, fourteen in the space of 5 mm. Lateral branches very much depressed; apertures a little larger, more nearly circular and more conspicuous than on the midrib, opening laterally, separated by about two-thirds the diameter of an aperture; when occurring opposite a dissepiment they frequently extend a short distance upon it and open directly outward. Peristomes of all the apertures thin, distinctly and equally elevated. Dissepiments abruptly rounded and very much depressed.

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Formation and localities. Hamilton group, Moscow, Livingston county, and other localities in Central and Western New York; and also at West Williams, Ontario, Canada.

Ptilopora infrequens, n. sp.

PLATE LXVI, FIGS. 26-29.

Midrib slender, width, on the fragments observed, about .33 mm., scarcely tapering; branches one-half the width of the midrib, distant about 1.25 mm.; midrib and branches striated, striæ alternating in size. Dissepiments very slender, much depressed below the plane of the branches, and not expanding at their junction. The celluliferous face has not been observed.

This species will be easily distinguished from *Ptilopora striata* and *P. nodosa* by the much less frequent lateral branches.

Formation and locality. Hamilton group, Western New York. Particular locality not recorded.

PTILOPORA NODOSA.

PLATE LXVI, FIG. 25.

Ptilopora nodosa, HALL. Trans. Albany Institute, vol. x, p. 196. 1881.
" " " Report of State Geologist for 1883, p. 59. 1884.

ZOARIUM consisting of a stipe or midrib proceeding from a spreading base attached to other organic bodies, and having equidistant lateral branches, connected by dissepiments. On the fragments observed the stipe is about .33 mm. in width, essentially uniform in size; transverse section circular or broadly oval; lateral branches about .20 mm. in width, regularly distant more than twice the width of a branch, eight or nine in the space of 5 mm., diverging from the midrib at an angle of about seventy-five degrees.

On the non-celluliferous face the midrib and lateral branches are convex, and finely striated. Dissepiments abruptly rounded, finely striated, depressed below the plane of the branches and scarcely expanding at their junction, usually occurring at intervals of about 1 mm. or a little less.

On the celluliferous face the midrib is of about the same convexity as on the opposite face; the lateral branches are more abruptly convex; midrib finely striated, and with a row of comparatively prominent equidistant nodes along the middle, about eleven in the space of 5 mm. Cell apertures oval, in two ranges, opening laterally; looking directly upon the midrib they are scarcely distinguishable, on the branches they are more conspicuous; separated by about two-thirds the length of an aperture, fifteen in the space of 5 mm. Peristomes thin, distinctly and equally elevated. There is a row of nodes along the middle of the branches, smaller and more closely disposed than those on the midrib. Dissepiments sharply rounded, striated, much depressed below the plane of the branches.

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Formation and locality. Hamilton group, Railroad cutting, two and one-half miles east of Alden station, Erie county, N. Y.

FENESTRAPORA, Hall. 1884.

Fenestrapora biperforata.

PLATE LXVI, FIGS. 34-39.

Fenestrapora biperforata, Hall. Report of State Geologist for 1884, pl. 2, fig. 17. 1885.

Bryozoum infundibuliform; branches moderately slender, width above a bifurcation from .20 to .30 mm., increasing to .45 or .50 mm., straight, sinuous or zig-zag, according to the position of the dissepiments; narrower portions of the branches rounded or sub-angular, becoming flattened as they approach a bifurcation; sometimes there is a strong striation along the middle of the flattened branch, having the appearance of a carina; at other times there are irregularly disposed, short, interrupted striations and frequently the branch is marked by numerous, comparatively strong granules or small nodes; there are also pores or perforations, irregularly disposed and greatly varying in number in different fronds, often numerous, sometimes oval, length .30 mm., width one-third the length, without peristomes; at other times these pores are elongate-triangular, the upper portion strongly elevated; these pores sometimes occur on the dissepiments, and altogether they frequently form the most conspicuous feature of this face of the frond. Interstices wider than the branches. Dissepiments strong, width from .30 to .40 mm., and occasionally even more, flattened or rounded, on a plane with the branches and expanded at their junction, five in the space of 5 mm. Fenestrules oval, length generally from .60 to .70 mm., width from one-half to two-thirds the length.

On the celluliferous face the branches are angular. Dissepiments rounded, much depressed. Fenestrules narrower than on the opposite face. Cell apertures in two ranges, sometimes slightly oblique to the axis of the branch, opening almost directly outward, eighteen in the space of 5 mm., separated by less than the diameter of an aperture. Peristomes strong, distinctly elevated, indenting the borders of the fenestrules. Surface between the ranges of apertures carinated; carina about .25 mm. in height, for about one-half that distance very thin, then rapidly expanding to a width of .10 or .12 mm., the summit usually flat, and with a row of oval pores, which are frequently

nearly or quite in contact; one portion of the peristomes is much the more strongly elevated, sometimes giving a nodes appearance; occasionally the summit of the carina is angular and has two rows of nodes.

Formation and localities. Hamilton group, Moscow, Livingston county; Muttonville, North Bristol Township, Ontario county; Montieth's Point, west shore of Canandaigua lake, Ontario county; Black Point, Canandaigua lake, N. Y., and other localities in the central and western part of the State.

NOTE.—The two following species were omitted in the proper place in the text of the volume, pages 87 and 98.

LICHENOTRYPA, ULRICH. 1885.

LICHENALIA (LICHENOTRYPA) LONGISPINA.

PLATE XXV, FIGS. 11, 12.

Lichenalia longispina, HALL. Trans. Albany Institute, vol. x, abstract, p 11. 1881.
Lichenotrypa cavernosa, ULRICH. Cont. Amer. Pal., vol. 1, No. 1, p. 24. 1885.
" *longispina*, HALL. Report of State Geologist for 1886, advance sheets. Pl. 35, figs. 11, 12. 1886.
" *aspera*, ULRICH. Cont. Amer. Pal., vol. 1, pl. 2, fig. 1.

ZOARIUM consisting of thin lamellate expansions, incrusting other objects. In the earlier stages of growth the cell tubes are extremely short, the apertures oval, length from .25 to .30 mm., width two-thirds the length, closely and irregularly disposed. Peristomes strong, sub-equally elevated. Interapertural space smooth, flat or slightly concave. In the course of growth the intermediate space is traversed by thin walls, having a height of .50 mm. or more, and frequently connecting the posterior portions of the peristomes, inclosing the apertures in polygonal areas, and having the appearance of an irregular net-work. At the angles of the elevations there are prominent spines which sometimes attain a height of 1 mm. or more. The peristomes of many of the apertures are elevated equally with the interapertural walls. Intercellular space irregularly vesiculose.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Prismopora sparsipora.

PLATE XXXII, FIGS. 24-28.

Thallostigma sparsipora, Hall. Trans. Albany Institute, vol. x, abstract, p. 13. 1881.
Prismopora " " Report of State Geologist for 1885, advance sheets. Pl. 32, figs. 25–28. 1886.

Zoarium consisting of triangular, bifurcating branches, sides concave, two of them equal in length, the third a little wider. Cell apertures minute, oval or obscurely trilobate, arranged in oblique, ascending rows, from the middle of each face, comparatively infrequent; the apertures at the middle of the branch are the smallest, having a length of about .18 mm., gradually growing larger to the margin, where they have a length of from .22 to .25 mm., and are frequently pustuliform. Peristomes strong, equally elevated, and with two slight denticulations on the posterior portion. Surface flat, finely granulose.

All the specimens observed are flattened, and in this condition have very much the appearance of Lichenalia. It may be distinguished from *P. subconcava* and *P. triquetra* by its wider branches and more distant apertures; from *P. paucirama* by its smaller and more infrequent cell apertures; from *P. lata* by its narrower branches, smaller and more infrequent cell apertures.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

CLONOPORA, Hall. 1881.

Clonopora fasciculata, n. sp.

PLATE LXVI, FIGS. 1, 2.

Zoarium simple or ramose, from 1 to 1.50 mm. in diameter. Cell tubes cylindrical, of nearly uniform size their entire length, diameter about .33 mm.; for two-thirds their length they are sub-parallel, diverging very gradually, then turning abruptly outward, they continue growth at an angle of about forty-five degrees to the axis of the zoarium. On one frond, which is apparently well preserved, the cells cease growth on turning outward.

Formation and locality. Upper Helderberg group, Onondaga Valley, N. Y.

Clonopora semireducta.

PLATE LXVI, FIGS. 3, 4.

Clonopora semireducta, Hall. Trans. Albany Institute, vol. x, abstract, p. 20. 1881.

Zoarium ramose, branches generally consisting of an aggregation of cylindrical cell tubes, diameter about 1 mm.; cell tubes 2.50 in length, diameter .25 mm.; essentially parallel with the axis of the branch until within about 1 mm. of the aperture, where they turn abruptly outward and continue at nearly right angles to the axis. Most of the specimens consist simply of an aggregation of cell tubes, but some of them have apparently an intercellular substance.

This species may be distinguished from *C. fasciculata* by its smaller size.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

Clonopora incurva.

PLATE LXVI, FIGS. 5, 6.

Clonopora incurva, Hall. Trans. Albany Institute, vol. x, abstract, p. 20. 1881.

Zoarium about 1.50 mm. in diameter. Length of cell tubes from 3.50 to 4 mm., gradually enlarging to the aperture, where the diameter is about .50 mm. Eight or ten cells commence growth at the same time at the center of the stipe, gradually diverging till within 1.50 mm. from the apertures, when they turn abruptly outward. The apertures are spirally arranged, the group of cells being umbelliform, the zoarium consisting of a succession of these groups of cells.

Formation and locality. Upper Helderberg group, Manlius, N. Y.

ADDENDA.

RECEPTACULITES, De France. 1827.

Receptaculites infundibuliformis.

PLATE XXIV, FIGS. 3–11.

Coscinopora infundibuliformis, (Goldfuss) Eaton. Geol. Text Book. 1833.
Receptaculites infundibuliformis, (Eaton) Hall. Sixteenth Rept. N. Y. State Cabinet of Nat. Hist., p. 67. 1863.
" " " " Report of State Geologist for 1882. Expl. pl. 23, fig. 10. 1883.
Receptaculites monticulatus, Hall. Report of State Geologist for 1882. Expl. pl. 23, figs. 3–9, 11. 1883.
Not *Coscinopora infundibuliformis*, Goldfuss.

Sponge usually discoid, sometimes broadly infundibuliform. The upper surface is more or less depressed with frequently a small conical projection in the center. The summit plates of the spicules are from 1 to 4 mm. in width. The best preserved specimens show prominent nodes or spines at the angles of junction of the cavities left by the solution of the plates of the upper layer, which probably are the fillings of perforations at the angles of the junction of the spicular plates, as described by Dr. J. G. Hinde in *R. occidentalis*, Salter, (Quar. Jour. Geol. Soc., vol. xl, pl. 37, figs. 3d, f. g.) Vertical spicules from 4 to 8 mm. in length and from 1 to 2 mm. in diameter. The largest specimen observed measures 140 mm. across the disk and has a central depressed area 100 mm. in diameter. The smallest specimen yet noticed has a diameter of 29 mm., and the height of the cup is about 15 mm.

The forms indicated under the name *R. monticulatus*, in the Report of the State Geologist, prove to be small and better preserved specimens of the original species described by Eaton.

Formation and locality. In the shaly limestone of the Lower Helderberg group, near Clarksville, Albany county, N. Y.

ISCHADITES, MURCHISON. 1839.

ISCHADITES SQUAMIFER.

PLATE XXIV, FIGS. 1, 2.

Dictyocrinites, CONRAD. Ann. Rept. Geol. Survey, N. Y. 1841.
Dictyocrinus squamifer, HALL. Pal. N. Y. Vol. iii, p. 135, p. 7A, figs. 11–13. 1859.
Receptaculites " " Report of State Geologist for 1882. Expl. pl. 23, figs. 1, 2. 1883.

BODY pyriform, regularly rounded on the base, conical above and perforate at the summit by an aperture about 5 mm. in diameter. The summit plates of the spicules have curved edges and appear to imbricate, the lower sides being depressed below the anterior edges of the adjacent inferior plates. In the zonal region the plates have a width of from 1 to 2 mm., and their size decreases very gradually towards the base and quite rapidly towards the summit, where they have a width of less than 1 mm. The vertical spicular rays were very slender, having a thickness of about 5 mm. from their distal extremities. The original specimen figured by Mr. Conrad has a height of 34 mm., and a diameter of 33 mm. at the lower third of the height.

Specimens of this species are quite uncommon and so far as observed they are usually completely filled with chalcedony. The type specimen, however, is filled with calc spar.

Formation and locality. In the limestones of the Lower Helderberg group at Schoharie, N. Y.

ISCHADITES BURSIFORMIS.

PLATE XXIV, FIGS. 12–14.

Receptaculites bursiformis, HALL. Report of State Geologist for 1882. Expl. pl. 23, figs. 12–14. 1883.

THE original form of this sponge is not clearly shown in the specimens at hand on account of the various degrees and directions of compression to which they have been subjected. Three specimens are sub-pyriform with terminal summits, and two are discoidal with eccentric summits. The zonal plates have a width of about 2.5 mm. Near the summit they are small and very numerous, and have a width of about 1 mm. None of the specimens show

the nature of the vertical spicules, but they usually preserve the impression of the terminal radial spicules in the rhombic concavities left in the removal of the summit plates of the spicules. The largest specimen observed is very much compressed and shows a length of 100 mm., and a diameter of nearly 80 mm. A small pyriform specimen has a length of 33 mm., and a diameter of 25 mm.

These sponges are very poorly preserved, in common with the majority of the fossils from the Schoharie grit, and show obscurely the superficial characters. It is, however, interesting to record this form from that horizon, as none have previously been described from arenaceous rocks.

This species may be readily distinguished, from *I. squamifer*, of the Lower Helderberg group, by the larger summit plates of the spicules, with no appearance of imbrication.

Formation and localities. In the Schoharie grit, Albany and Schoharie counties, N. Y.

Thamniscus nanus.

PLATE LXVI, FIGS. 11-13.

Thamniscus nanus, Hall. Trans. Albany Institute, vol. x, abstract, p. 19. 1881.

Zoarium fruticose; bifurcations frequent, occurring at intervals of from 1 to 2.50 mm.; branches diverging at an angle of from fifteen to forty-five degrees. Non-celluliferous face rounded, becoming flattened just below a bifurcation. Cells tubular, cylindrical. Cell apertures circular or slightly oval; diameter from .20 to .25 mm.; very irregularly disposed, distance apart varying from contact to .50 mm. or more. Peristomes strong, usually equally elevated, but sometimes the posterior portion is the more prominent.

Formation and locality. Upper Helderberg group, Falls of the Ohio river.

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PLATES AND EXPLANATIONS.

PLATE I.

STREPTELASMA STRICTUM.

Page 1.

Fig. 1. An individual of the ordinary or prevailing size.

Fig. 2. A lateral view of an individual of somewhat smaller size, showing the rapid increase of lamellæ by interstitial additions along a single line upon one side of a continuous ray.

Fig. 3. Anterior view of another individual where the rays increase by additions on one side of the anterior ray.

Fig. 4. An unusually large individual of the species, showing a rapid increase in the number of rays on one side, for some distance from the base, above which point the increase takes place in another part of the coral.

Fig. 5. An individual showing an increase by successive budding — a rare condition in the Helderberg and Schoharie regions, but common in some other localities.

Fig. 6. A longitudinal section showing the vertical lamellæ which are somewhat complicated at the center, but without transverse septa.

Fig. 7. The calyx of a well-preserved specimen showing the disposition of the lamellæ.

Fig. 8. An enlargement of the calyx from another specimen in which the arrangement of the lamellæ is very distinctly shown.

Fig. 9. A vertical section of a specimen showing a central columella.

Fig. 10. A transverse section below the base of the open calyx showing the disposition of the lamellæ.

Lower Helderberg group. *Clarksville, N. Y.*

ZAPHRENTIS RŒMERI.

Page 2.

Fig. 11. A lateral view of a specimen of the ordinary or prevailing size and form, showing the intermittent growth usually characteristic of the species.

Fig. 12. A more elongate and less regular form which has expanded much less rapidly in its progress of growth than the prevailing forms.

Fig. 13. An individual of unusually large size, preserving the epitheca almost entire.

Fig. 14. A very large individual from which the epitheca has been principally removed.

Figs. 15, 16. The calyx in specimens where the depression of the anterior ray is strongly marked.

Fig. 17. The calyx of a specimen where the anterior ray is not conspicuous.

Fig. 18. A calyx where the anterior ray is obscurely marked a little on one side of its usual position.

Fig. 19. A calyx where the condition of growth presents the transverse septum over a considerable portion of its area, the lamellæ not having extended to the center. The anterior fosette is conspicuous.

Fig. 20. An individual which has been broken so as to exhibit the transverse septa.

Fig. 21. A specimen broken longitudinally and showing numerous closely arranged tabulæ in the central portion, with the lamellæ well preserved in the upper part of the calyx.

Lower Helderberg group. *Clarksville, N. Y.*

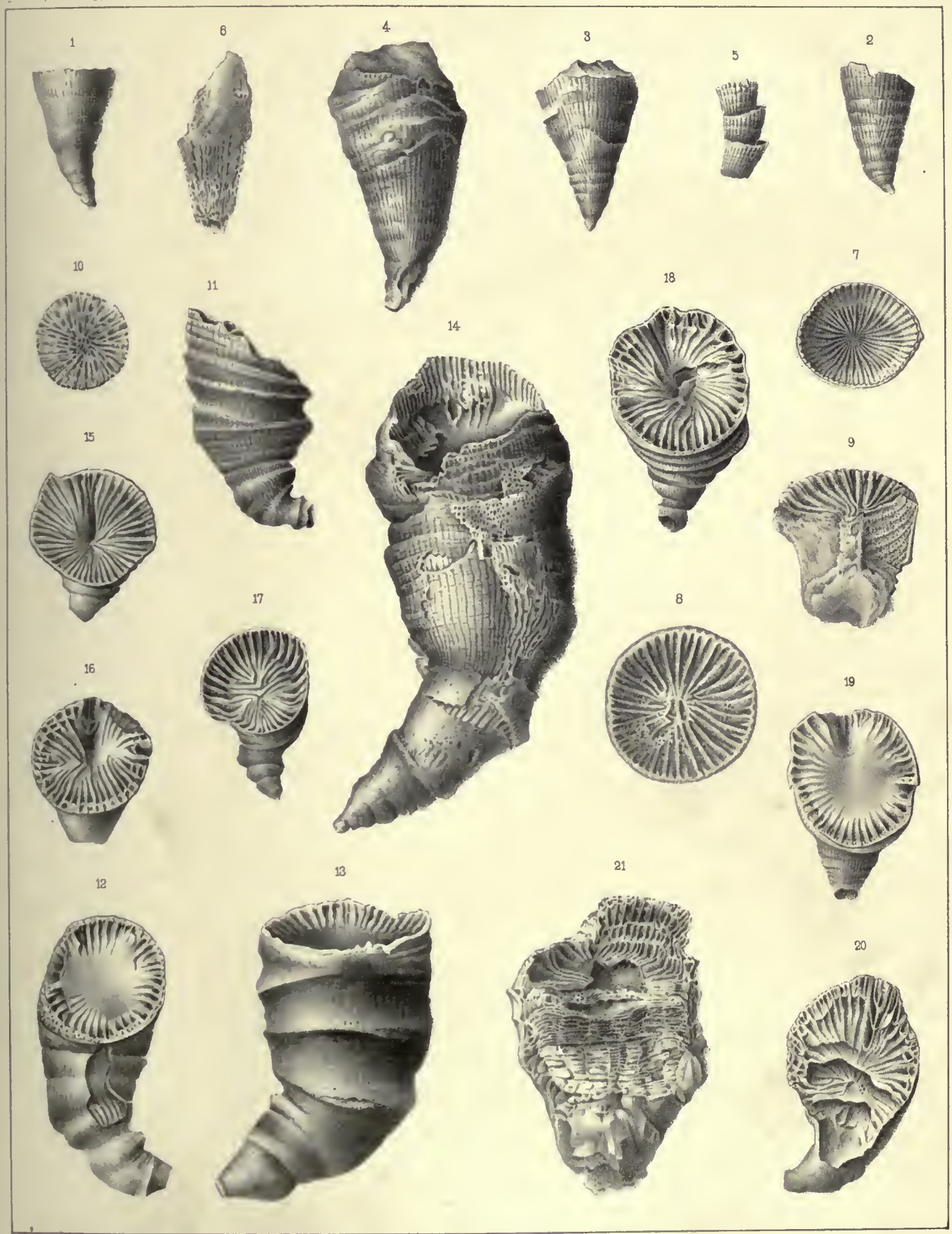
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PLATE II.

Aulopora Schohariæ.

Page 3.

Fig. 1. A specimen, natural size, attached to the surface of *Atrypa reticularis*.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. A specimen upon a piece of limestone, showing a mode of budding in a more direct line than usual.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 3. Another specimen on the surface of a fragment of limestone, showing a compacty arranged colony, the cells diverging and tending to form a reticulate arrangement.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 4. An enlargement from fig. 3.

Fig. 5. An enlargement showing a varying size of cells on the same specimen.

Fig. 6. An enlargement of a specimen, showing a partial abortion of two of the cells, while a third has continued to enlarge.

Aulopora tubula.

Page 3.

Fig. 7. A colony of cells attached to a fossil shell and closely crowded in their mode of growth.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 8. A colony of cells which have grown upon the surface of a Strophodonta—less crowded in their mode of growth than in fig. 7.
Lower Helderberg group. *Schoharie, N. Y.*

Aulopora subtenuis.

Page 4.

Fig. 9. A fragment of rock preserving a small colony in which the budding is more directly lateral and more distant, and the tubes more slender than in either of the preceding species.
Lower Helderberg group. *Clarksville, N. Y.*

Figs. 10, 11. Two slender specimens, natural size, showing some slight variation in the budding.
Lower Helderberg group. *Clarksville, N. Y.*

Figs. 12, 13. Enlargements, to three diameters, of parts of a specimen of this species.

Fig. 15. A group of cells of natural size, which are slightly stouter, and enlarging more rapidly than the preceding specimens.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 16. An enlargement from the preceding, showing the mode of growth, and the manner of budding in a direct line along the convex side of the tube. The surface shows distinct longitudinal striæ with transverse corrugations giving a papillose surface.

Figs. 17, 18. Specimens presenting the same characters as the preceding, except that the tubes are more direct, less curved and more slender.

PLATE II—Continued.

AULOPORA ELONGATA.

Page 5.

Fig. 14. A specimen showing some variation in the mode of growth.
Lower Helderberg group. *Schoharie, N. Y.*

Figs. 19, 20. Natural size and enlargement of a stouter form, having a smoother surface and otherwise differing from the preceding.
Lower Helderberg group. *Schoharie, N. Y.*

CORNULITES MODESTUS, n. sp.

Aulopora? Cornulites. Report of State Geologist for 1882. Expl. pl. 2, figs. 21, 22. 1883.

Figs. 21, 22. Natural size and enlargement of a single tube, showing a strongly corrugated surface.
Lower Helderberg group. *Clarksville, N. Y.*

VERMIPORA ? TORTUOSA.

Page 6.

Fig. 2. A group of three tubes enlarged to six diameters.

VERMIPORA SERPULOIDES.

Page 5.

Fig. 24. A small branch, natural size, showing the bases of branchlets which have been broken off.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 25. An enlargement from fig. 24, showing the form and arrangement of the cell tubes.

Fig. 26. A large specimen with numerous branches.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 27. A larger branch with a single bifurcation.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 28. An enlargement of a specimen showing angular cell tubes.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 29. A longitudinal section, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 30. An enlargement illustrating the characteristic mode of growth. A single tube on one side may be traced for nearly two-thirds the entire length of the specimen.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 31. A longitudinal translucent section, showing the mode of increase of the cells.

VERMIPORA ROBUSTA.

Page 6.

Figs. 32, 33. Two fragments, natural size, showing the form of cell apertures and mode of growth.
Lower Helderberg group. *Clarksville and Schoharie, N. Y.*

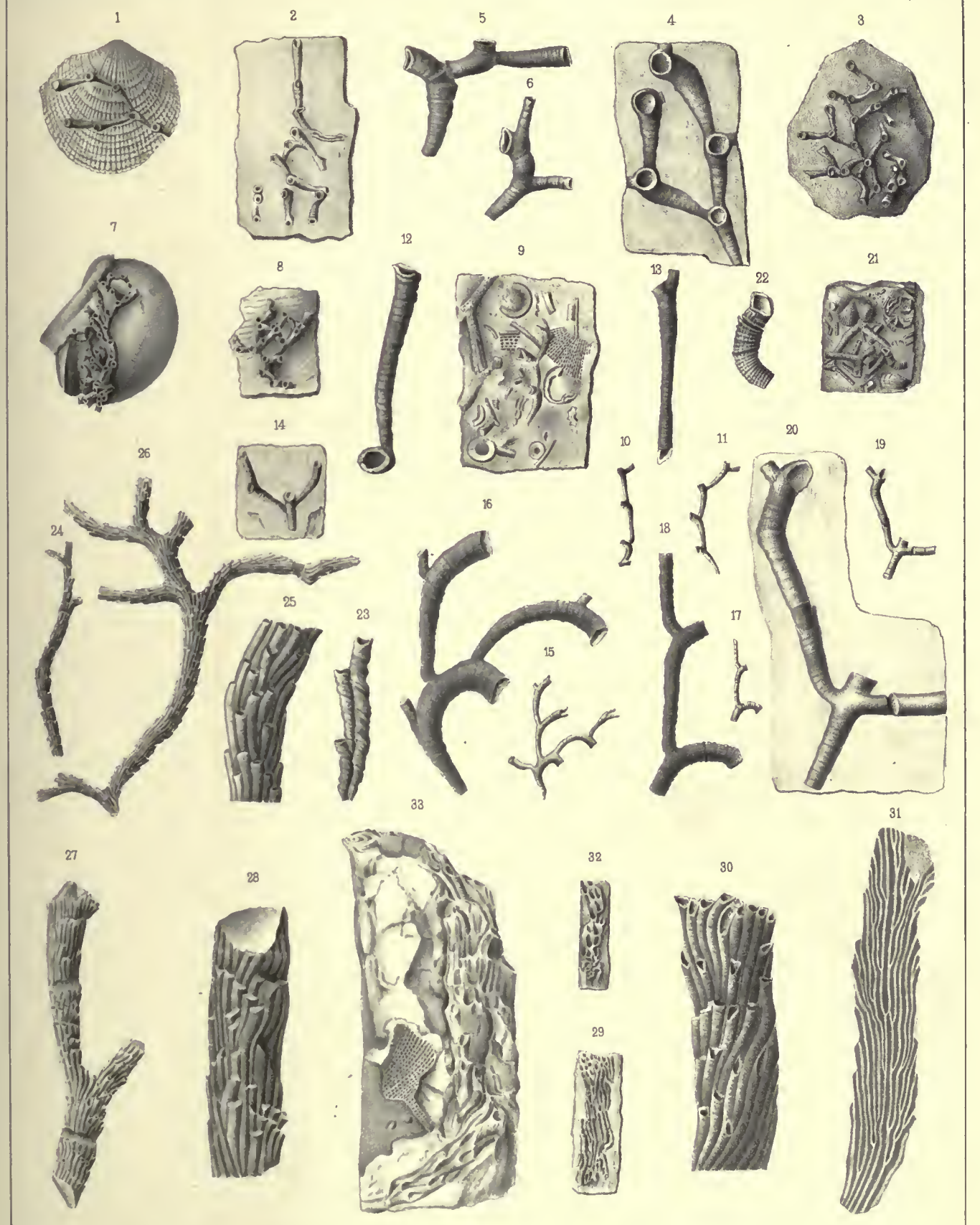
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PLATE III.

MICHELINIA LENTICULARIS.

Page 7.

Fig. 1. The summit of a specimen of ordinary dimensions. The cells are partially filled with the original matrix, and their full form and depth is therefore not represented in the figure.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 2. A profile of the preceding specimen.

Fig. 3. An enlargement of a single cell, which is partially filled with rock.

Fig. 5. The base of an example, preserving the epitheca and pedicel of attachment.
Lower Helderberg group. *Schoharie, N. Y.*

FAVOSITES CONICUS.

Page 9.

Fig. 4. An enlargement of some of the cell tubes, showing the mural pores.

Fig. 6. The summit of a young specimen which is imperfect from the presence of some extraneous object which has become imbedded in it during growth.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 7. The base of a specimen which partially preserves the epitheca.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 8. The base of a small specimen with the epitheca preserved on one side.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 9. A vertical section of the ordinary full-sized specimen, showing the cell tubes and mural pores.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 10. A vertical section showing the cell walls and septa.
Lower Helderberg group. *Near Cumberland, Md.*

Fig. 11. An outline showing form and size of the largest specimen of the species observed.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 12. A lateral view of a large individual showing the cell apertures and preserving the epitheca near the base.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 13. The base of the same, showing a partial preservation of the epitheca in some parts.

STRIATOPORA ISSA.

Page 6.

Fig. 14. A fragment of a specimen, natural size.

Fig. 15. An enlargement, showing the striations on the inner side of the cell walls and the mural pores.
Lower Helderberg group. *Clarksville, N. Y.*

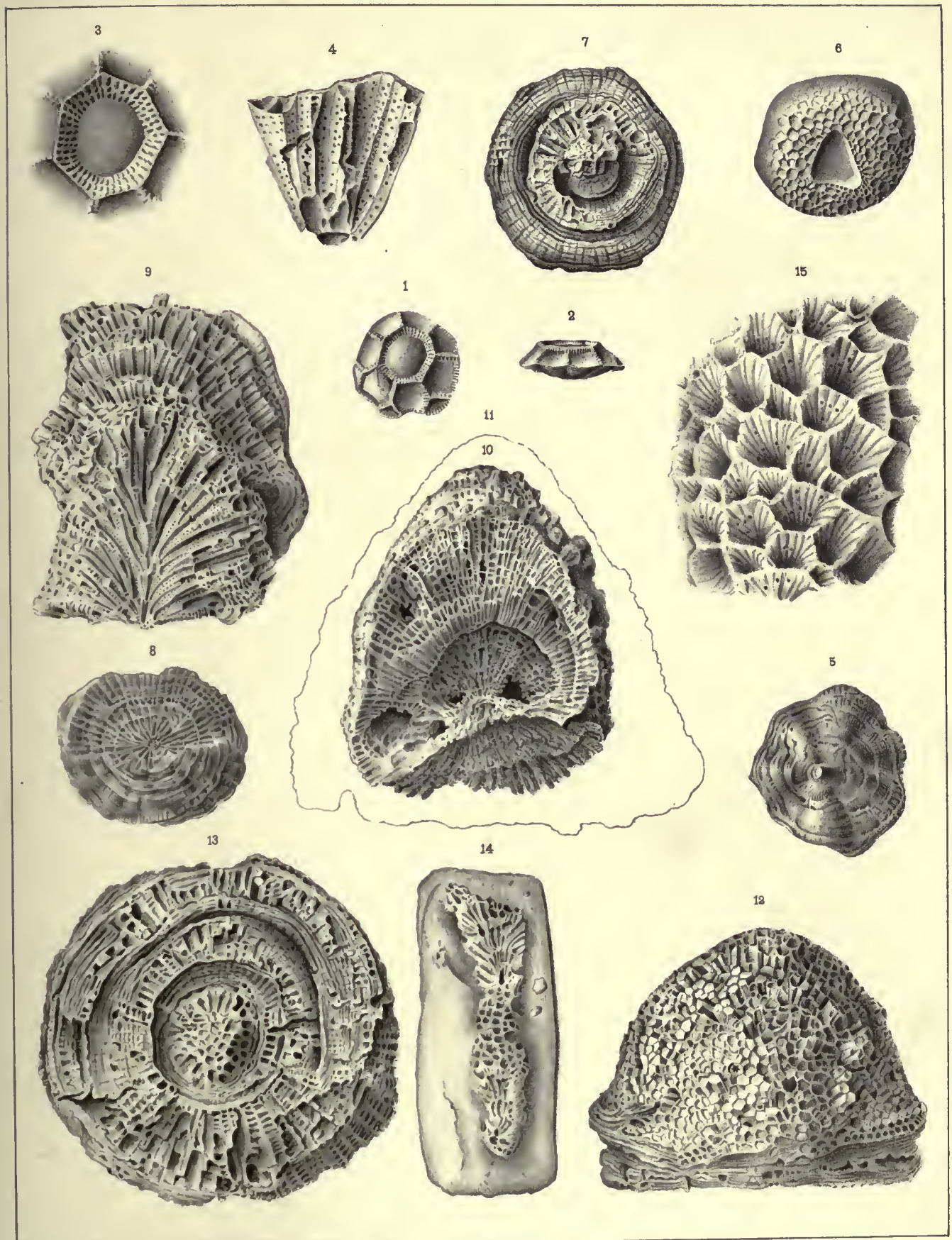
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PLATE IV.

FAVOSITES HELDERBERGIÆ.

Page 8.

See Plates 5, 6.

Fig. 1. The lower side of a highly conical form which preserves the epitheca in an unusual degree of perfection.

Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. The lower side of a more explanate form, from which the epitheca has been nearly removed by weathering or solution, leaving the silicified cell walls and some of the septa. Some of the cells are entirely filled with siliceous matter and others are free.

Lower Helderberg group. *Clarksville, N. Y.*

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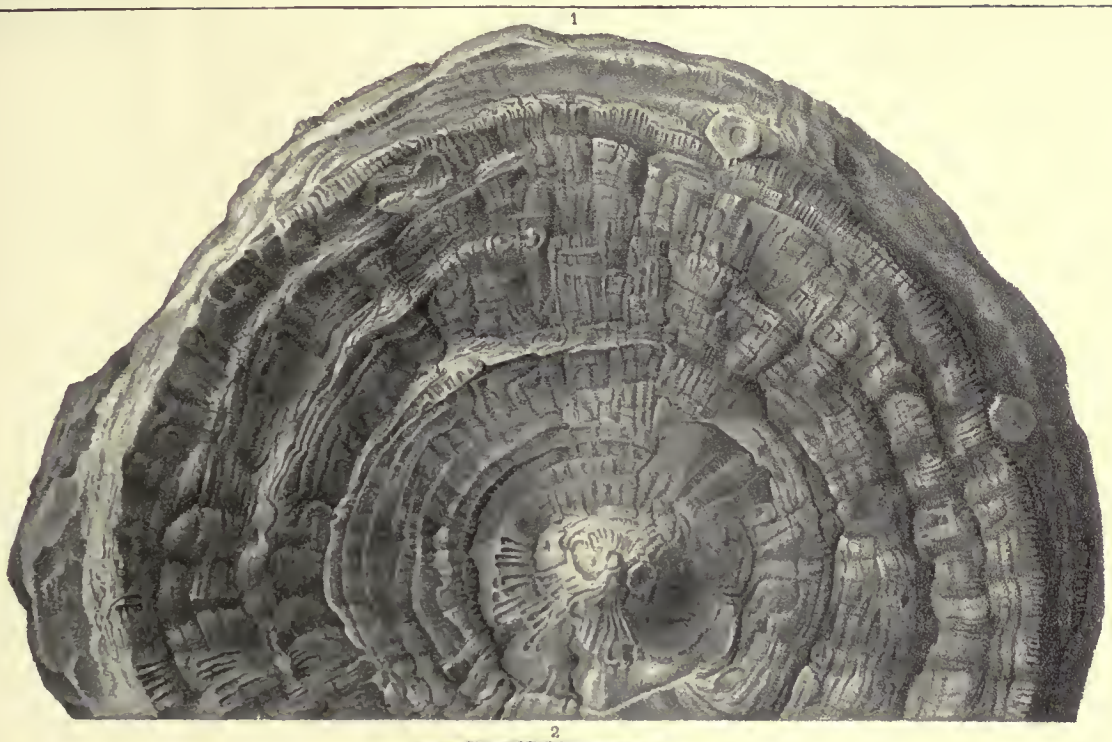

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G.B.Simpson del

H.Bergman lith.

PLATE V.

FAVOSITES HELDERBERGIÆ.

Page 8.

See Plates 4, 6.

Fig. 1. An elongate subturbinate form, showing larger cells at intervals, most of which are filled with siliceous matter.

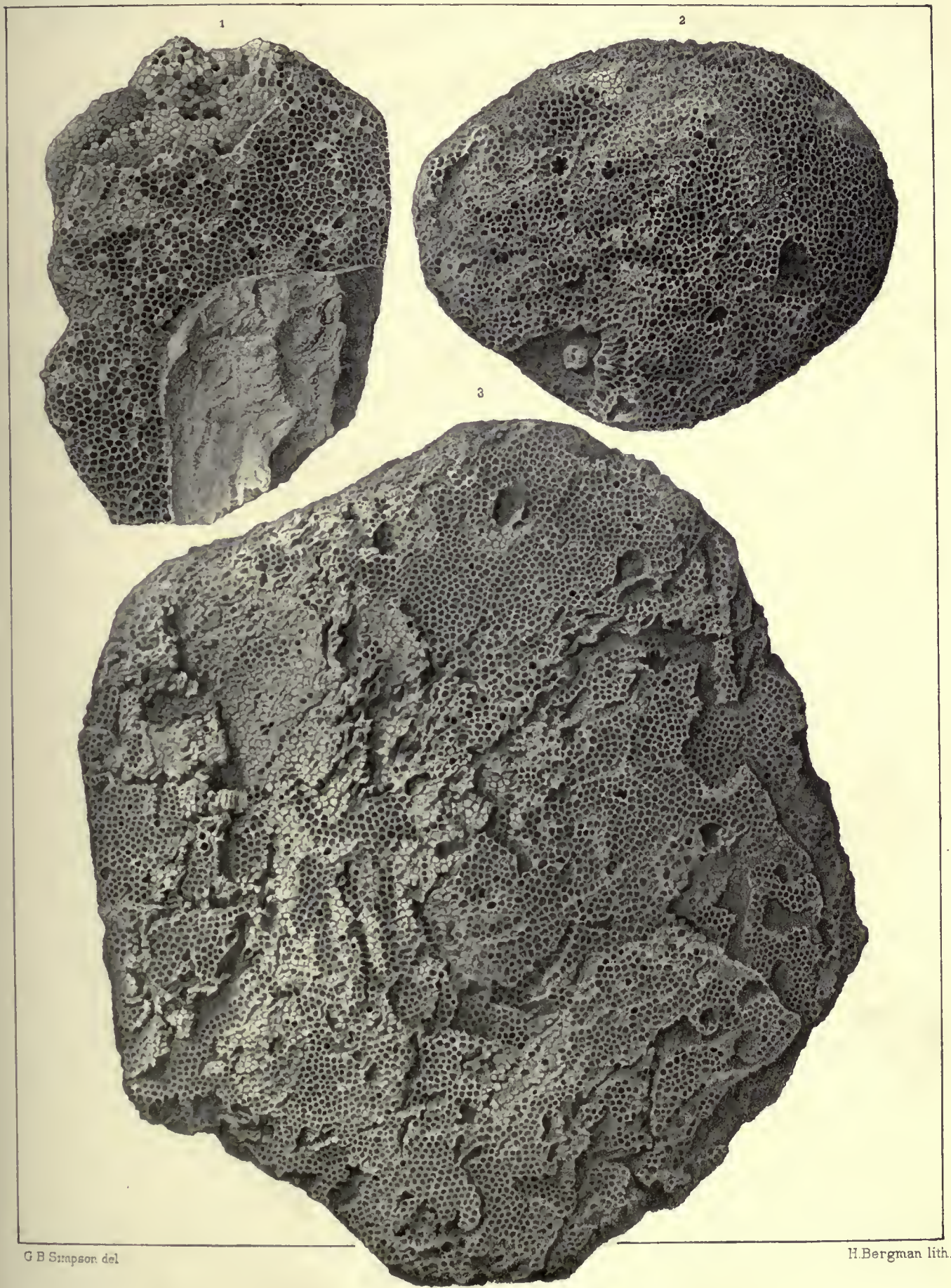
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. A broad, turbinate form of the species.

Lower Helderberg group. *Clarksville, N. Y.*

Fig. 3. A depressed, hemispheric form where the vertical extent is about one-fifth or one-sixth of the diameter. The figure represents the convex upper side of the specimen, fig. 2, plate 4, which is the prevailing form in many localities.

Lower Helderberg group. *Clarksville, N. Y.*



G B Simpson del

H.Bergman lith.

PLATE VI.

Favosites Helderbergiæ.

Page 8.

See Plates 4, 5.

Fig. 1. The upper surface of a subturbinate form, which differs from the prevailing specimens in having numerous and somewhat regularly distributed larger cells, which are subcircular at their apertures.

Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. A specimen of unusually elongate or elevated turbinate form, presenting numerous larger cell apertures, which are more conspicuous near the base.

Lower Helderberg group. *Clarksville, N. Y.*

Fig. 3. A vertical section of a specimen similar to fig. 3 of the preceding plate, in which the cells are free from filling, and preserve, in an unusual degree, the transverse septa.

Lower Helderberg group. *Clarksville, N. Y.*

Fig. 4. A portion of a similar specimen enlarged, the septa being somewhat thickened from silicification.

Fig. 5. A vertical section where the cells are filled with siliceous matter, marked by the transverse septa and showing the pores in the lateral walls, the mass being quite solid.

Lower Helderberg group. *Clarksville, N. Y.*

Fig. 6. A portion of specimen fig. 5, enlarged to show more distinctly the mural pores.

Fig. 7. A portion of a hemispheric mass where the columns, or filled cells, are slightly smaller, and the open cells with more closely arranged septa than the prevailing forms of the species in New York.

Lower Helderberg group. *Near Cumberland, Md.*

Fig. 8. A hemispheric form, which is entirely silicified and solid, in which the cells are distinctly smaller than the prevailing forms in New York.

Lower Helderberg group. *Near Cumberland, Md.*

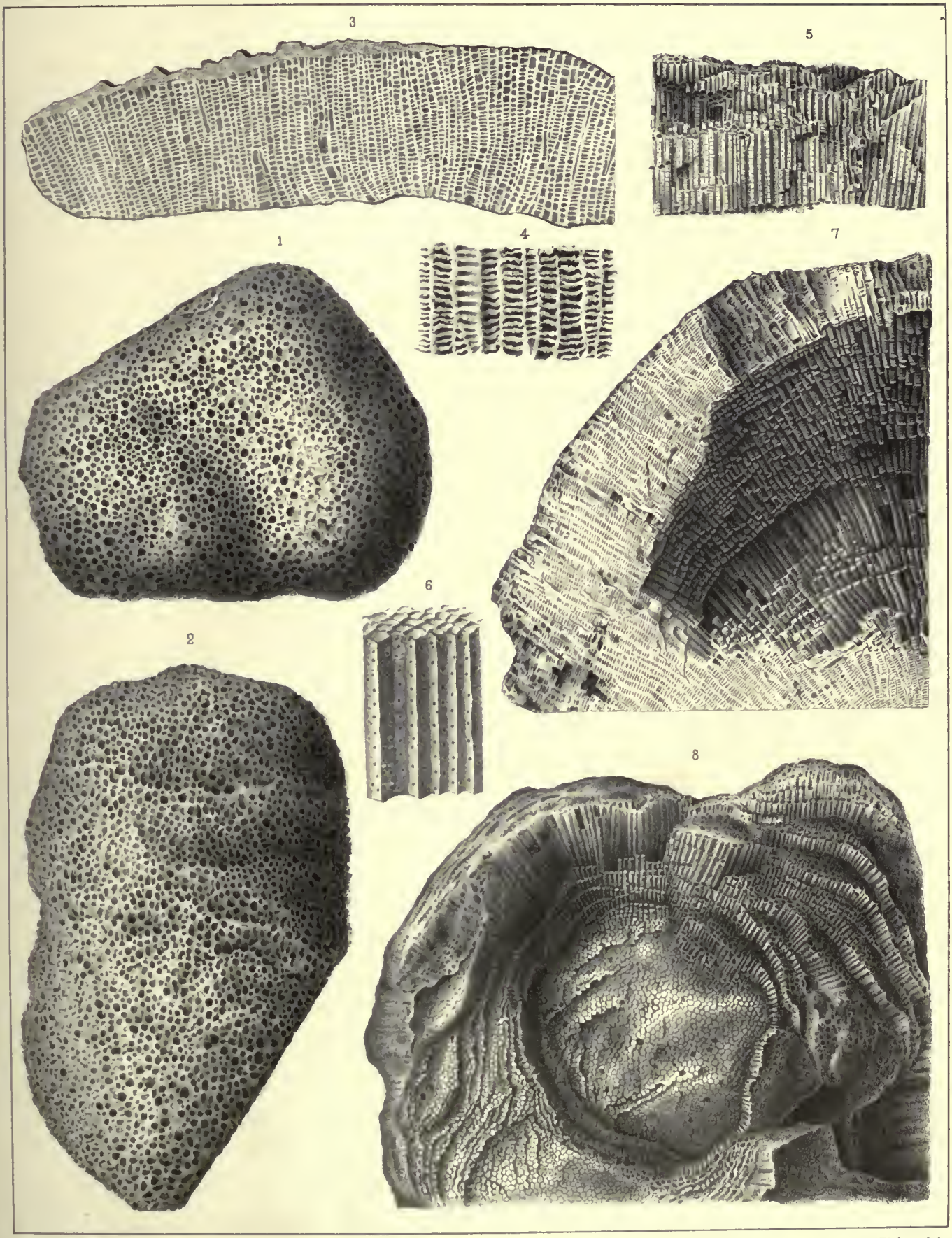

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PLATE VII.

FAVOSITES SPHERICUS.

Page 9.

See Plate 8.

Fig. 1. A vertical section showing the columns and illustrating the mode of growth.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. A lateral view of a specimen showing the depressed conical form, the expanded margin being in part broken away.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 3. A portion of a coral growing in an irregular form.

Fig. 4. A specimen which has grown upon the base of the stem of Lepadocrinus.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 5. An individual of this species, which is more distinctly laminated in its mode of growth. The coral commenced its growth upon the stem of a crinoid which it entirely enveloped, but the latter has subsequently become exposed from the weathering away of the coral.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 6. An elongate form, having the same structure as the massive forms.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 7. A portion of a massive form which has been perforated by some boring animal, and now preserves the filling of these cavities.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 8. An enlargement from the specimen fig. 1. The columns are essentially smooth.

Fig. 9. An enlargement of the columns from another specimen, erroneously showing mural pores.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 10. An enlargement from fig. 3, showing the columns with corrugated surface.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 11. An enlargement of the surface showing the form of the cell openings.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 12. An enlargement of the open cells from a translucent section, showing comparatively few and irregularly distributed septa (× 6).

FAVOSITES PROXIMUS.

Page 10.

Fig. 13. An irregular hemispheric mass showing the mode of growth.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 14. An enlargement of the surface showing the cell apertures.

Fig. 15. An enlargement from a translucent section showing the septa and obscurely the mural pores.
Lower Helderberg group. *Schoharie, N. Y.*

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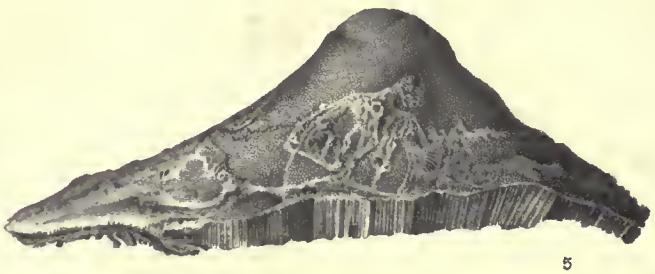
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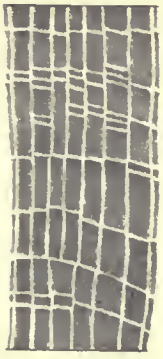
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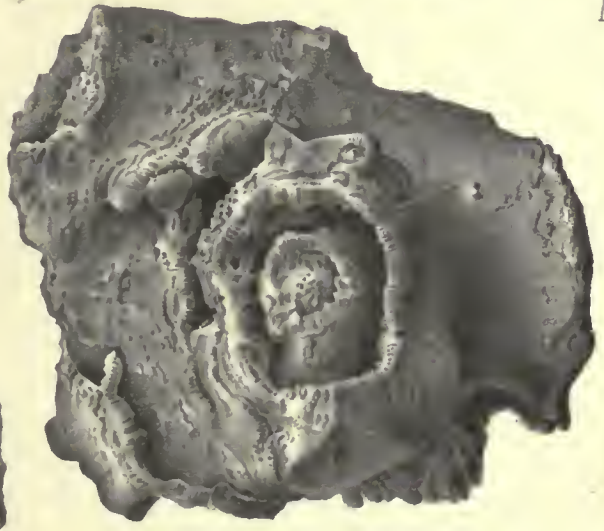
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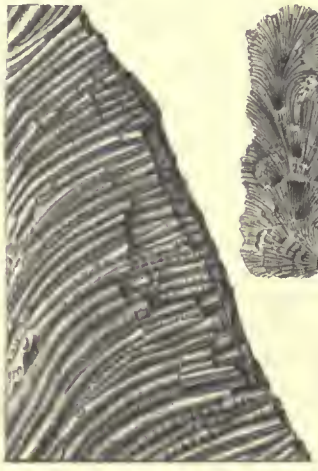
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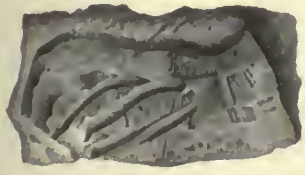
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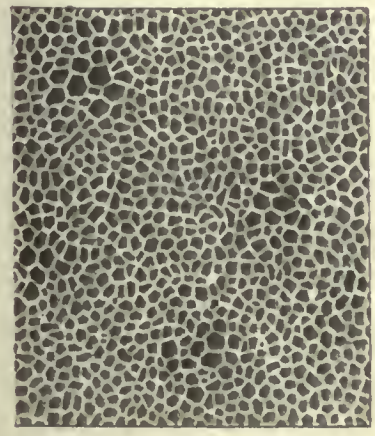
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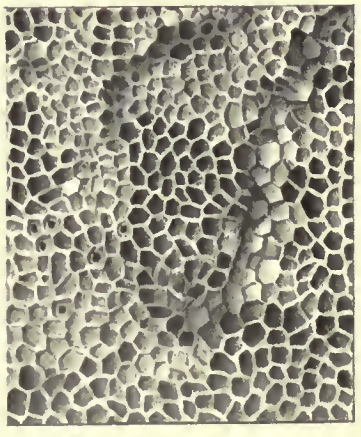
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PLATE VIII.

Chætetes colliculatus.

Page 11.

Fig. 1. An ovoid depressed-conical form, showing the mode of growth and the nodes covering the surface.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 2. A subhemispheric form showing the nodose character of the surface.
Lower Helderberg group. *Schoharie. N. Y.*

Fig. 3. An enlargement from the surface of fig. 1, showing the form of cell apertures, etc.

Fig. 4. An enlargement from a vertical translucent section from specimen fig. 2.

Chætetes monticulatus.

Page 12.

Fig. 5. A spheroidal-ovoid specimen, natural size. The nodes are well preserved on the upper part, but obscure on the lower part.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 6. An enlargement of the surface from fig. 5.

Fig. 7. A translucent section from fig. 5, showing the irregular form of the cells, the transverse septa, and the laminæ causing interruption in the continuity of the cells.

Favosites sphæricus.

Page 9.

See Plate 7.

Fig. 8. A growth of this species upon *Favosites Helderbergiæ*, which continuing for some time is succeeded by Stromatopora, which in turn is followed by *Favosites sphericus*, and again by Stromatopora.

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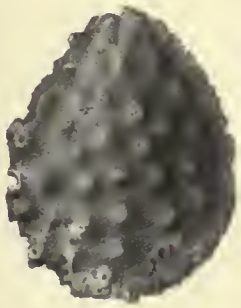

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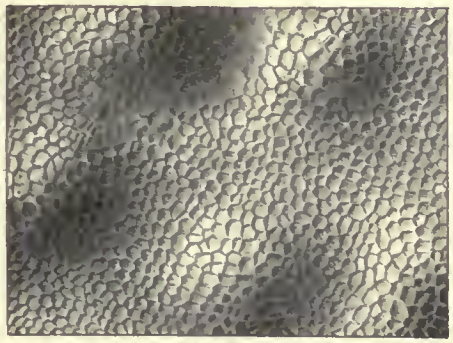

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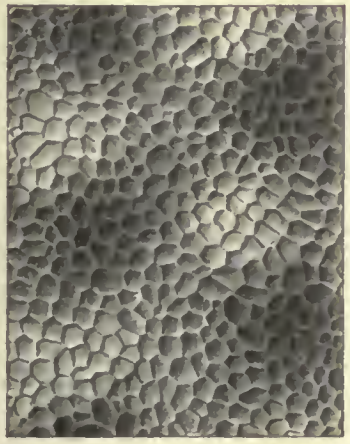

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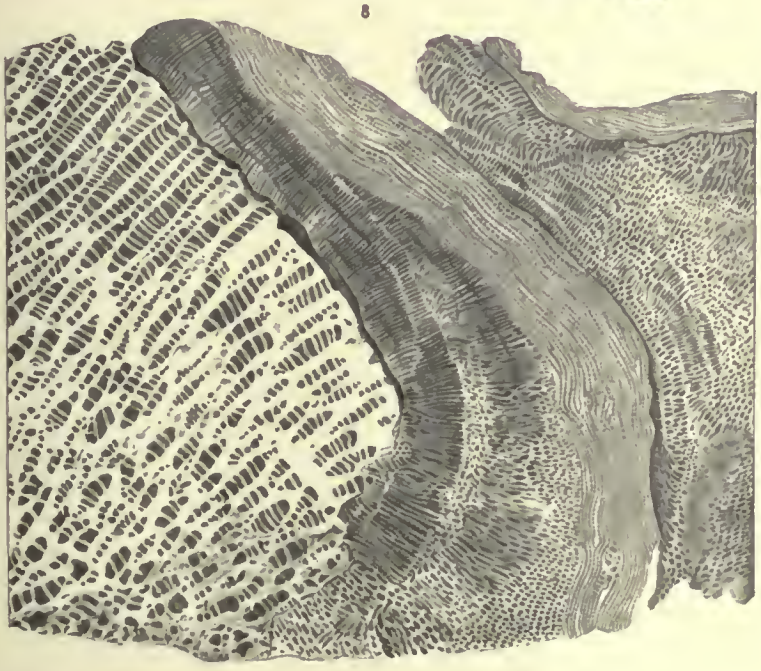

PLATE IX.

Chætetes (Monotrypella) arbusculus.

Page 12.

Fig. 1. A branching specimen on a fragment of limestone, natural size.
Tentaculite limestone. *Schoharie, N. Y.*

Fig. 2. A separate branching specimen, natural size.
Tentaculite limestone. *Schoharie, N. Y.*

Fig. 3. The base of a group of the same character as fig. 2.
Tentaculite limestone. *Schoharie, N. Y.*

Fig. 4. A fragment, natural size, showing a peculiar mode of growth, and referred to this species with doubt.
Tentaculite limestone. *Schoharie, N. Y.*

Fig. 5. Fragments of branching forms, natural size, apparently of the same species as fig. 4.
Tentaculite limestone. *Schoharie, N. Y.*

Fig. 6. An enlargement from the surface of fig. 5, showing the character of the branches and the cell openings.

Fig. 7. An enlargement from fig. 1, showing cell apertures and form of the columns from the cell filling.

Fig. 8. A branching specimen, somewhat more slender than the prevailing forms.
Lower Helderberg group. *Schoharie, N. Y.*

Chætetes (Monotrypella) abruptus.

Page 13.

Fig. 9. An irregularly branching specimen which is weathered or broken so as to show the columns.
Lower Pentamerus limestone. *Schoharie, N. Y*

Fig. 10. An enlargement from the preceding, showing the surface characters and cell apertures.

Fig. 11. A translucent section, enlarged, from the base of a bifurcation, showing the characters of the cells, which in the center are nearly or quite free from septa, turning rapidly outward and becoming frequently septate as they approach the surface.

Ptychonema tabulatum.

Page 14.

Fig. 12. A vertical section of a hemispheric mass showing the columns with corrugated sides.

Fig. 13. An enlargement of a portion showing the peculiar corrugated surfaces of the columns.

Fig. 14. An enlargement of a vertical translucent section showing the undulated cell walls.

Fig. 15. A transverse section showing the form of the cells. (× 6).

Ptychonema Helderbergiæ.

Page 15.

Fig. 16. A portion of a branching form presenting the same character of cell walls as the preceding.

Fig. 17. An enlargement of the surface showing the form of the cell apertures.

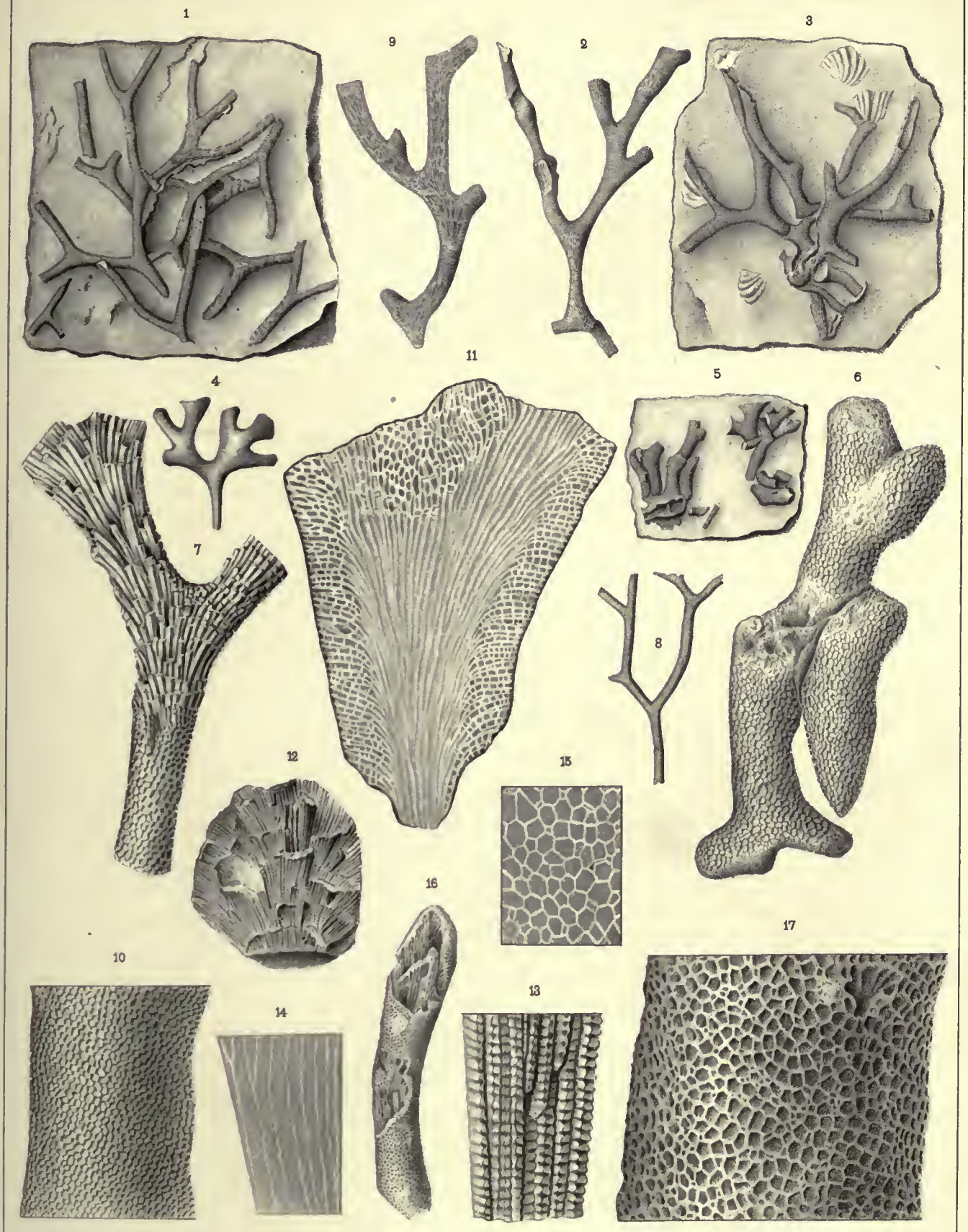
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PLATE X.

Trematopora ? (Trematella ?) corticosa.

Page 15

See Plate 13.

Fig. 1. A branching fragment, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. An enlargement from the preceding, showing the regularly oval cell apertures.

Fig. 3. An enlargement from another specimen, showing the presence of elevated ridges between the ranges of cell apertures.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 4. An enlargement showing cell apertures somewhat transversely arranged, and a little more elongated than in figs. 1 and 2. A fragment of a Callotrypa adheres to the upper part of the specimen.

Fig. 5. An enlargement showing various forms of cell apertures.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 6. An enlargement from a translucent section, showing the cell walls, the septa, and the divergence of the cells toward the surface.

Fig. 7. A specimen of natural size, showing a rectangular mode of branching.
Lower Helderberg group. *Clarksville, N. Y.*

Fig 8. A specimen of natural size, showing the branches diverging almost rectangularly.

Fig. 9. A curving stipe with the branches diverging rectangularly from one side.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 10. A branching stipe where the long branch on the right-hand side shows the mark of a branch broken from the upper side, and the base of one coming off on the lower side.
Lower Helderberg group. *Clarksville, N. Y.*

Chætetes (Monotrypella) densus.

Page 14.

Fig. 11. A branching specimen of natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 12. An enlargement showing the surface characters, cell apertures, etc.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 13. A longitudinal section enlarged, showing the mode of increase in the cells, their freedom from septa in the center of the branch, and their septate characters as they approach the apertures.

Diamesopora constricta.

Page 19.

See Plate 23 a.

Fig. 14. A fragment, natural size, showing in part the poriferous surface, and where the branch is broken, the wrinkled interior of the epitheca.

Fig. 15. An enlargement from the preceding, showing areas of larger cells and their mode of radiating from the more prominent ones.

Fig. 16. Fragments on a piece of limestone; the upper part of the right-hand specimen in the figure is of this species, growing upon or incrusting another form shown below it.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 17. A surface enlargement from the preceding, showing a more regular arrangement of cell apertures than in fig. 15. The cell apertures are more trilobate than represented in the figure.

Fig. 18. A bifurcating fragment of the species.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 19. An enlargement from fig. 18, showing the constriction of the cell apertures.

Diamesopora dispersa.

Page 20.

Fig. 20. A fragment, natural size.

Fig. 21. An enlargement from the surface of the preceding, showing the form and irregular distribution of the cell apertures.
Lower Helderberg group. *Clarksville, N. Y.*

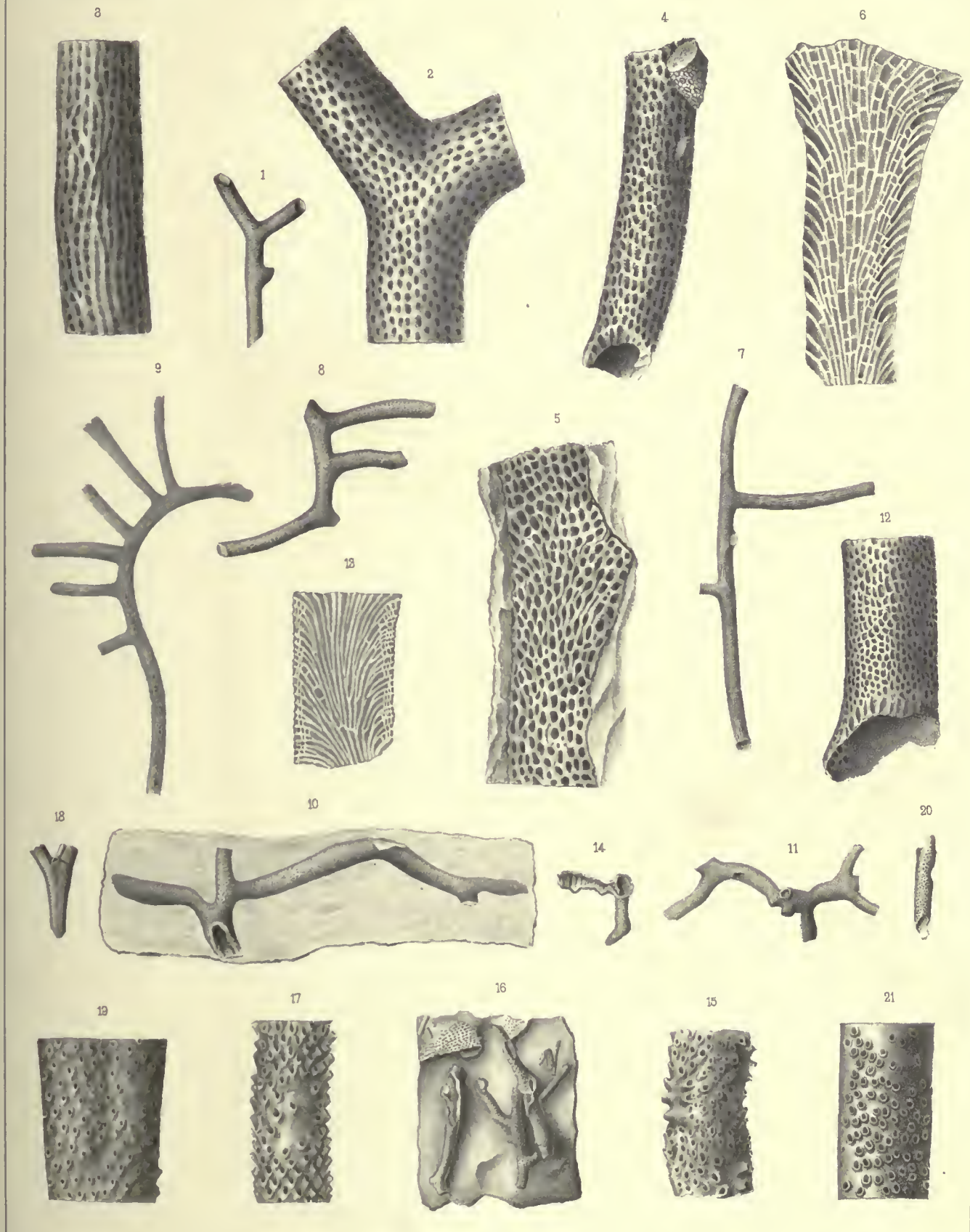
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PLATE XI.

TREMATOPORA (ORTHOPORA) REGULARIS.

Page 16.

See Plates 13 and 23.

Fig. 1. A piece of limestone with a group of fragments of this species, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. A specimen showing a rectangular mode of branching.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 3. A piece of limestone with this and other species on the surface.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 4. An enlargement, showing constricted cell apertures. (× 6.)
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 5. An enlargement, showing smooth, intermediate ridges.

Fig. 6. An enlargement, showing the transverse and longitudinal intercellular spaces nearly equal.

Fig. 7. An enlargement, showing the longitudinal spaces thickened and serrated.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 8. A specimen of this species, showing granulose longitudinal ridges and a minute spine at the base of each cell aperture.

TREMATOPORA (ORTHOPORA) OVATIPORA, *Hall.*

Page 17.

See Plate 23.

Fig. 9. A fragment, natural size.
Lower Helderberg group. *New Salem, N. Y.*

Fig. 10. An enlargement, showing the surface characters. The longitudinal interapertural spaces are granulose, the cell apertures are ovate and margined with granulæ, and have a minute spine at their lower and broader end.
Lower Helderberg group. *New Salem, N. Y.*

Fig. 11. A weathered specimen of this species.
Lower Helderberg Group. *Clarksville, N. Y.*

TREMATOPORA (ORTHOPORA) CANALICULATA.

Page 17.

See Plate 23.

Fig. 12. An enlargement from the minute specimen. The margins of the cells are raised and the interapertural spaces channeled and with comparatively strong granules at the extremities of the cells and on other parts of the surface.
Lower Helderberg group. *Helderberg Mountains, N. Y.*

TREMATOPORA (ORTHOPORA) PARALLELA.

Page 19.

See Plate 23.

Fig. 13. A small fragment of the fossil, natural size.

Fig. 14. A portion of the same enlarged.
Lower Helderberg group. *Clarksville, N. Y.*

PLATE XI—Continued.

TREMATOPORA (ORTHOPORA) RHOMBIFERA, *Hall.*

Page 18.

See Plate 23.

Fig. 15. (15*a*.) Two specimens of natural size, showing the extremes of size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 17. A specimen, natural size, having the principal branches nearly parallel with the main one, which is bifurcated above.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 18. A larger branching specimen, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 19. An enlargement showing the arrangement and form of apertures, with the interapertural partitions.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 20. An enlargement of a bifurcating branch where the cell apertures are constricted by the thickening of the intercellular substance.
Lower Helderberg group. *Clarksville, N. Y.*

STICTOPORA GRANATULA.

Page 38.

See Plate 23 A.

Fig. 16. A specimen, natural size.
Lower Helderberg group. *Catskill Creek, N. Y.*

LICHENALIA CRASSA.

Page 30.

Fig. 21. A flattened or crushed branching form, showing a distinct poriferous surface.

Fig. 22. An enlargement from fig. 21, showing the round and regularly arranged cell apertures in some parts, while the maculæ are without cell apertures.
Lower Helderberg group. *Schoharie, N. Y.*

CALLOPORA (CALLOTRYPA) MACROPORA.

Page 24.

See Plate 23.

Fig. 23. A weathered branching specimen, natural size.
Lower Helderberg group. *Catskill Creek, N. Y.*

Fig. 24. An enlargement from fig. 23.

Fig. 25. A bifurcating branch, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 26. An enlargement from the preceding, showing oval cell apertures and mostly one range of interapertural pits.

Fig. 27. A slender, branching form of this species.
Tentaculite limestone. *Schoharie, N. Y.*

Fig. 28. A small branching fragment.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 29. An enlargement from fig. 28, with larger cells than in fig. 26, and with few and irregularly disposed interapertural pits.

CALLOPORA (CALLOTRYPA) MACROPORA var. SIGNATA.

Page 25.

Fig. 30. A branching specimen, natural size.

Fig. 31. An enlargement from the preceding, showing cell apertures with occasional interapertural pits.
Lower Helderberg group. *Clarksville, N. Y.*

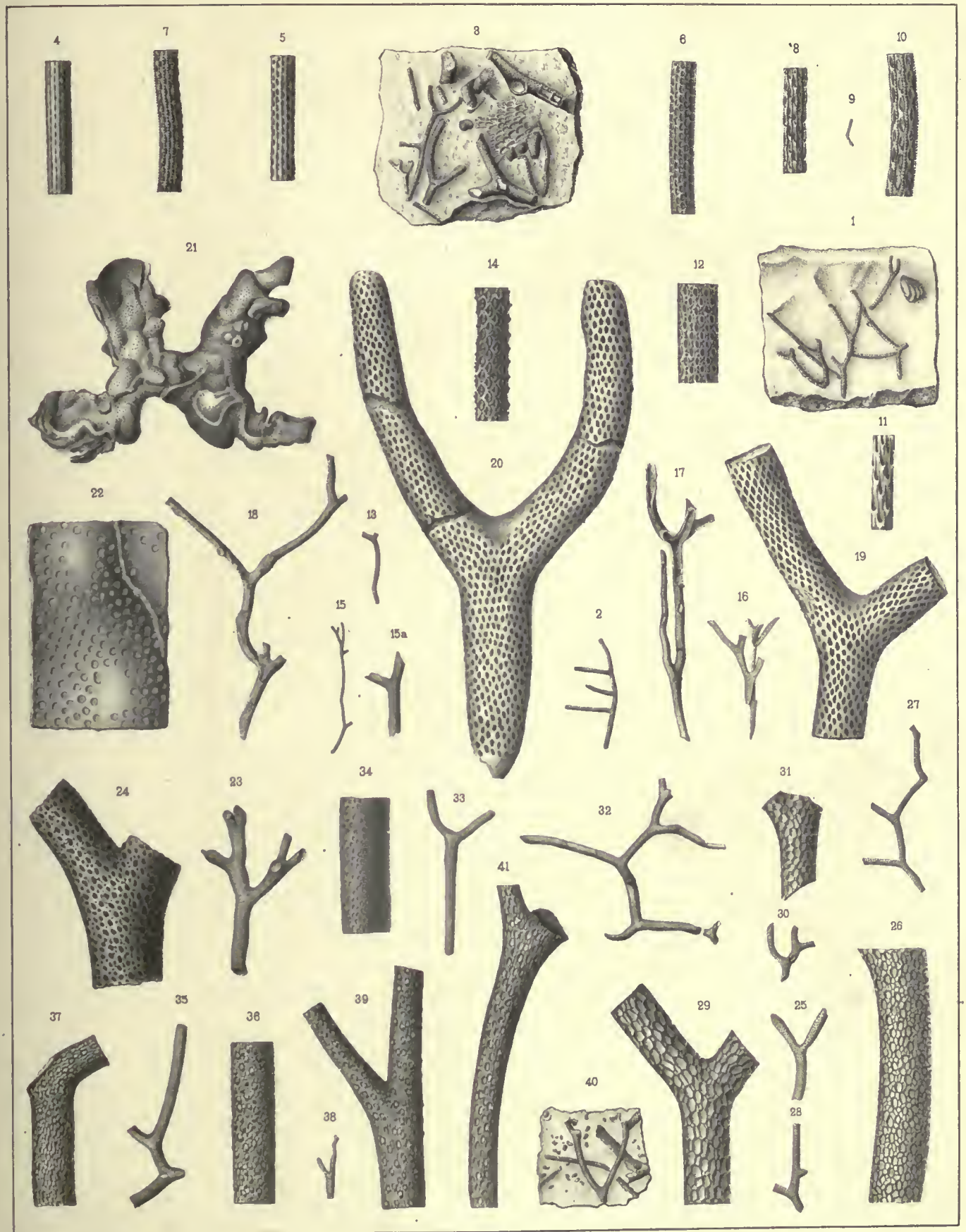
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PLATE XI—Continued.

CALLOPORA (CALLOTRYPA) HETEROPORA.

Page 25.

See Plates 13 and 23.

Fig. 32. An irregularly branching form, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 33. A bifurcating branch, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 34. An enlargement, showing the surface characters, and the small oval cell apertures with interapertural pits.

CALLOPORA (CALLOTRYPA) UNISPINA, *Hall.*

Page 26.

Fig. 35. A branching specimen, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 36. An enlargement, showing the surface characters—a minute spine at the base of each oval aperture with one or two ranges of interapertural pits.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 37. An enlargement, showing some of the cells with a minute spine, while it is absent from others.
Lower Helderberg group. *Clarksville, N. Y.*

CALLOPORA (CALLOTRYPA) STRIATA.

Page 26.

See Plate 23.

Fig. 38. A small fragment, natural size.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 39. An enlargement from the surface of the preceding, showing distant oval cell apertures, the interapertural pits elongate quadrangular, and this part of the surface striated.

Fig. 40. A piece of limestone with some small fragments distributed over the surface.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 41. An enlargement, showing irregularly arranged oval cell apertures without spines at their base, and the intermediate spaces striate, without being distinguished by pits.

PLATE XII.

CALLOPORA CELLULOSA.

Page 21.

See Plates 13 and 23 A.

Fig. 1. A fragment, natural size, showing mode of bifurcation and the numerous lateral openings.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. A simple stipe having the openings more regularly arranged.
Lower Helderberg group. *Near Catskill, N. Y.*

Fig. 3. An enlargement of a portion of the preceding.

Fig. 4. A piece of limestone with a fragment of this species and portions of several other forms.

Fig. 5. An enlargement of a portion of a branch, showing one of the fistulous openings from which radiating striæ extend.

Fig. 6. A fragment, natural size, showing numerous irregularly arranged openings.

Figs. 1–6 were originally described as *Callopora fistulosa*, HALL. (Thirty-second Rept. N. Y. State Mus. Nat. Hist., p. 154. 1879.) Subsequent observations have shown that these specimens are merely forms of growth of the present species.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 7. Two fragments of branching forms, showing mode of growth, cell apertures, etc.

Fig. 8. A small branch.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 9. An enlargement from the preceding, showing the surface characters of the species.

CALLOPORA PERELEGANS.

Page 22.

See Plate 23 A.

Fig. 10. An irregularly branching specimen, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 11. A more slender form with numerous branchlets.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 12. A small specimen with branches diverging in several directions, some of which are thickened at their extremities.

Fig. 13. A branching form, similar to, but more slender than the one represented in fig. 11.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 14. A branch, more slender in the central portion, and thickened above from the incipient branching.

Fig. 15. An enlargement of fig. 10 showing surface characters.

Fig. 16. A longitudinal section showing cell tubes, their mode of growth and divergence from the axis.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 17. The cell tubes and intermediate cellular interspaces, as seen in a longitudinal translucent section.

CALLOPORA (CŒLOCAULIS) HYALE.

Page 76.

See Plate 12.

Fig. 18. An irregularly growing branch which has been partially crushed.

Fig. 19. An enlargement, showing the surface characters.
Upper Helderberg group. *Onondaga Valley, N. Y.*

CALLOPORA (CŒLOCAULIS) VENUSTA.

Page 23.

See Plate 23 A.

Fig. 20. A slender branch, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 21. A larger bifurcating branch.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 22. An enlargement of the preceding, showing the surface characters.

Fig. 23. An enlargement showing the interior of a bifurcating branch, and a portion of the epitheca.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 24. A portion of a branch enlarging toward a bifurcation, showing constricted cell apertures, and also maculæ without cells.
Lower Helderberg group. *Clarksville, N. Y.*

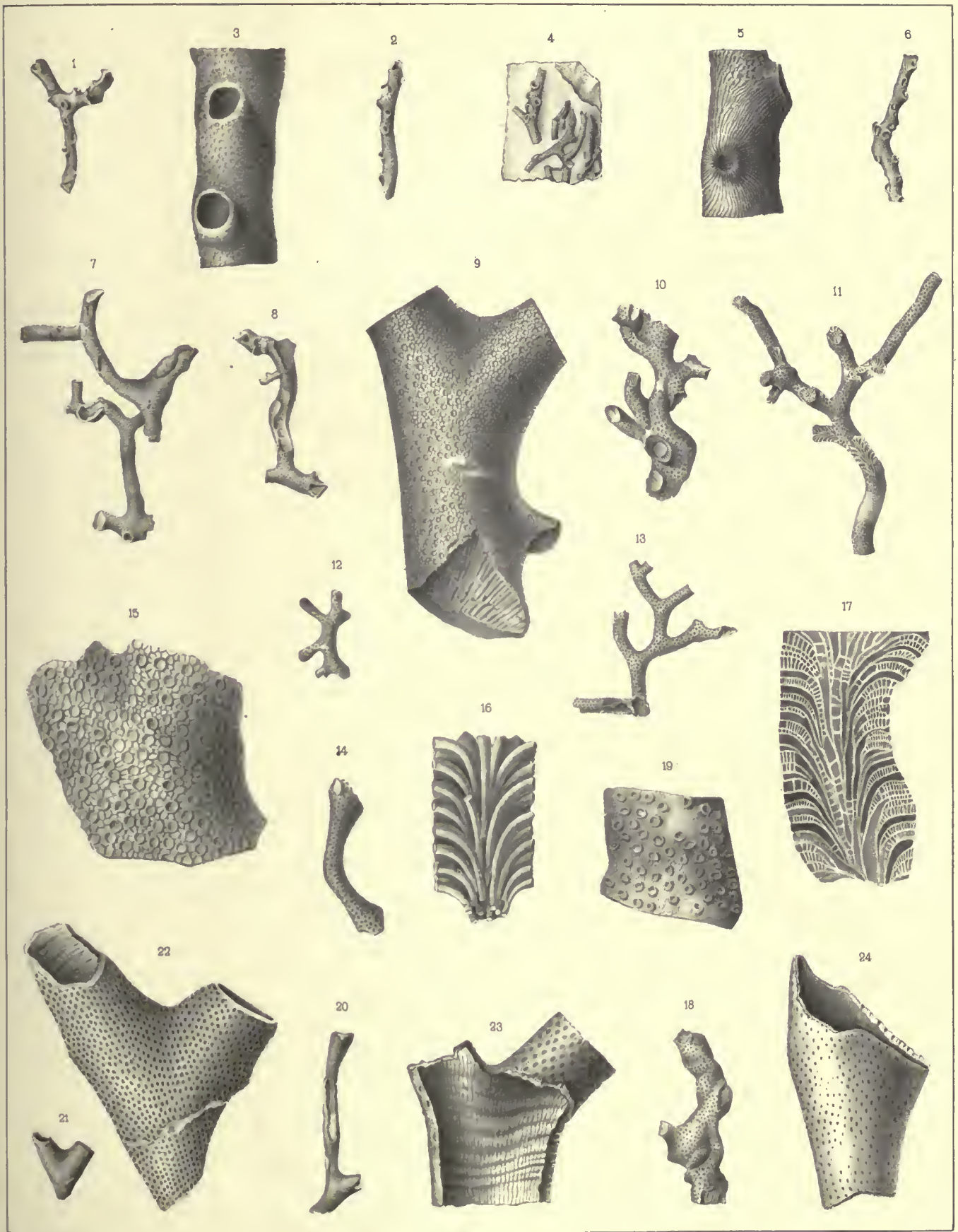
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PLATE XIII.

TREMATOPORA (ORTHOPORA) REGULARIS.

Page 16.

See Plates 11, 23.

Fig. 1. An enlargement of a small branch where the cells are not separated by a longitudinal ridge, and the interspaces are marked by comparatively strong spinules. (× 6.)
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. A fragment enlarged, having apertures elongated from weathering. The spinules in the interspaces are fewer and more slender than in the preceding specimen. (× 6.)
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 3. A fragment of another individual enlarged as the preceding. The surface presents an unusual number of ranges of cells, and the interapertural crenulate ridges are remarkably well preserved.
Lower Helderberg group. *Clarksville, N. Y.*

TREMATOPORA ? (TREMATELLA ?) CORTICOSA.

Page 15.

See Plate 10.

Fig. 4. A natural longitudinal section showing the mode of growth and the angular forms of the cell tubes.
Lower Helderberg group. *Clarksville, N. Y.*

CALLOPORA (CALLOTRYPA) HETEROPORA.

Page 25.

See Plates 11, 23.

Fig. 5. A branching fragment showing the natural size and mode of branching.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 6. A fragment of limestone preserving specimens of this species, with *Trematopora* (*Orthopora*) *regularis* and a species of *Fenestella*.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 7. An enlargement from fig. 5, showing the disposition of the cell apertures and the minute spines at their margins.

Fig. 8. An enlargement of a fragment of a branch of this species, where the spinules are so closely disposed as to obscure the cell apertures.
Lower Helderberg group. *Albany county, N. Y.*

CALLOPORA CELLULOSA.

Page 21.

See Plates 12, 23 a.

Fig. 9. A fragment of a branch enlarged, showing the closely arranged spinules on the margins of the cell apertures, and the interapertural pitted surface. (× 6.)
Lower Helderberg group. *Clarksville, N. Y.*

CALLOPORA (CALLOTRYPA) OCULIFERA.

Page 27.

See Plate 23.

Fig. 10. A fragment of a branch enlarged, showing the form and arrangement of the cell apertures and the interapertural pitted surface. (× 6.)
Lower Helderberg group. *Near Catskill, N. Y.*

Fig. 11. A fragment of limestone, showing the mode of occurrence of these forms of CALLOPORA, FENESTELLA, etc.
Lower Helderberg group. *Clarksville, N. Y.*

PLATE XIII—Continued.

STICTOPORA PAPILLOSA.

Page 37.

See Plate 23 A.

Fig. 12. A figure showing the mode of branching and arrangement of cell apertures.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 13. An enlargement of a fragment showing the form and arrangement of the cell apertures. (× 6.)
Lower Helderberg group. *Clarksville, N. Y.*

PTILODICTYA TENUIS.

Page 39.

See Plates 17, 23 A.

Fig. 14. An enlargement of the surface to show the mode of formation of the intercellular longitudinal partitions.
Lower Helderberg group. *Clarksville, N. Y.*

FAVOSITES HELDERBERGIÆ, ETC.

Fig. 15. A fragment of *Favosites Helderbergiæ* which has been overgrown by several other forms of corals as represented in the figure, each of which is indicated by a letter, as follows: *a. Favosites Helderbergiæ; b. Favosites sphæricus; c. Alveolites explanatus; d. Fistulipora ponderosa; h.* an inclosed cyathophylloid coral. The different expressions of *Alveolites, c,* are owing to the direction in which the cells are cut in a plane section of the mass.
Lower Helderberg group. *Schoharie, N. Y.*

ALVEOLITES EXPLANATUS.

Page 11.

Fig. 16. An enlargement of the surface, showing the form and striation of the cell apertures of the same species as shown in fig. 15.

LICHENALIA SERIALIS.

Page 32.

See Plate 15.

Fig. 17. An enlargement of the surface to show the form and arrangement of the cell apertures
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 18. An enlargement from the upper side of the epitheca, showing the procumbent position of the cellules, and the strong lateral cell walls on the left-hand side of the figure, where the cellules have been broken away.
Lower Helderberg group. *Clarksville, N. Y.*

FENESTELLA NOE.

Page 47.

Fig. 19. A fragment of a frond, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 20. An enlargement of the non-celluliferous side. (× 6.)

Fig. 21. An enlargement of the celluliferous side of a specimen.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 22. An enlargement of the celluliferous side. (× 6.)
Lower Helderberg group. *Clarksville, N. Y.*

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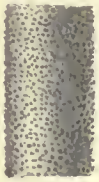
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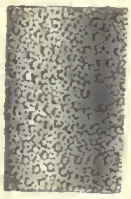
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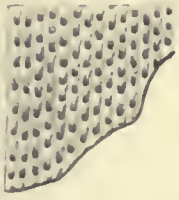
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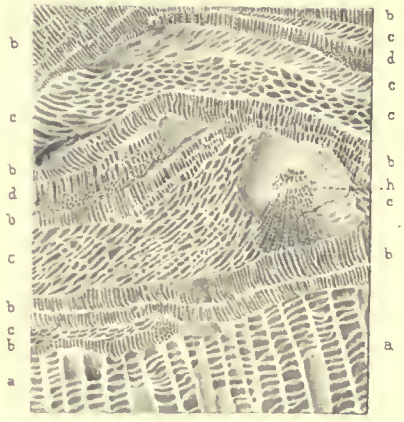

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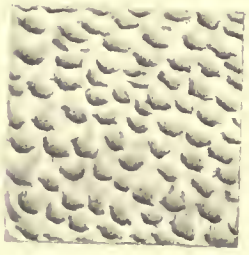
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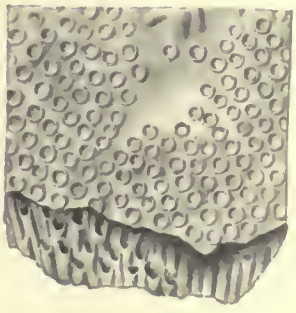
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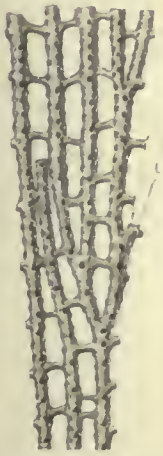
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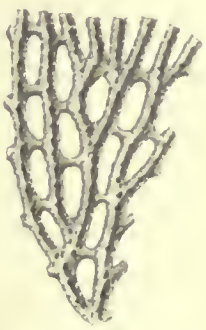
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PLATE XIV.

Lichenalia maculosa.

Page 30.

Fig. 1. An irregularly laminated massive form of the species.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. A conical form, presenting maculæ free from cells, and with the epitheca exposed at the base, from weathering.
Lower Helderberg group *Near Catskill, N. Y.*

Fig. 3. A vertical section, enlarged, showing the tubes and intercellular spaces.
Lower Helderberg group. *Schoharie, N. Y.*

Figs. 4–6. Surfaces, showing various phases of the arrangement and expression of the cell apertures.
Lower Helderberg group. *Albany and Schoharie counties, N. Y.*

Fig. 7. The tubes cut transversely, as seen in a translucent section.

Fig. 8. An enlargement from the surface of specimen fig. 1, showing the cell apertures and the repent position of the cell tubes.
Lower Helderberg group. *Clarksville, N. Y.*

Fistulipora ponderosa.

Page 27.

See Plate 23 A.

Fig. 9. A massive form, natural size.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 10. A vertical section of a portion of the preceding, showing the cell tubes.

Fig. 11. An enlargement from the surface of the specimen fig. 9, showing the characters of the cell apertures and the interapertural spaces.

Fig. 12. A portion of the surface of a specimen, which has been worn or partially exfoliated, showing the form of the cellules and the character of the intercellular spaces.
Lower Helderberg group. *Near Catskill, N. Y.*

Fistulipora parasitica.

Page 28.

See Plate 23.

Fig. 13. A specimen, natural size, growing on the frond of a Fenestella.
Lower Helderberg group. *Near Catskill, N. Y.*

Fig. 14. An enlargement of the preceding, showing the character of the cell apertures and interapertural spaces.

Fistulipora, sp. ?

Fig. 15. A branching fragment of Monotrypa overgrown with a species of Fistulipora.

Fig. 16. An enlargement from the surface of the preceding.

Fig. 17. A longitudinal section of the same, enlarged, showing the thin crust of Fistulipora. This specimen is introduced on this plate in error.
Hudson River group. *Cincinnati, Ohio.*

Callopora (Cœlocaulis) mediopora.

Page 23.

See Plate 23 A.

Fig. 18. An enlargement from the surface of a specimen, showing the cell apertures and interapertural pits of nearly equal size.

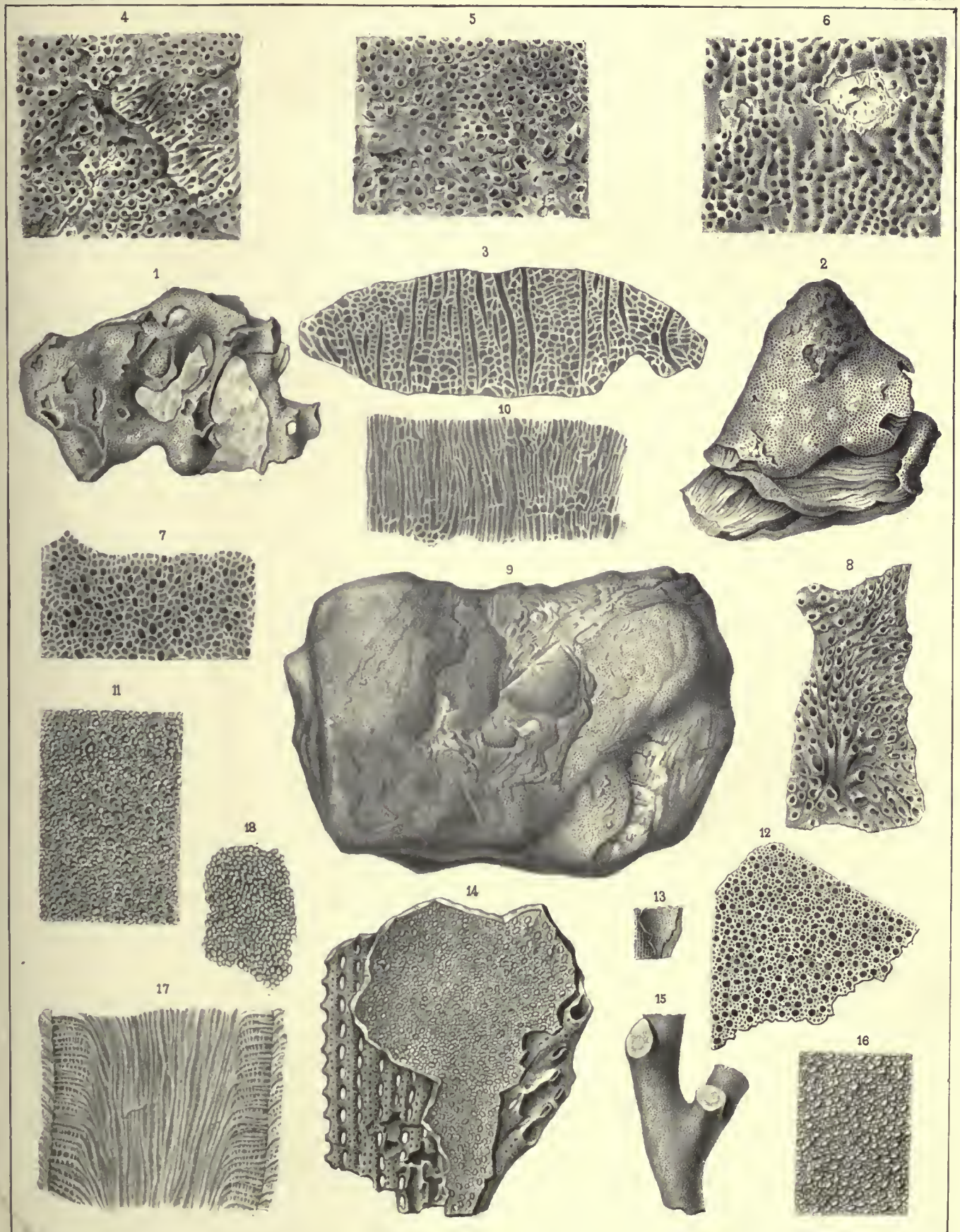
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PLATE XV.

LICHENALIA TORTA.

Page 31.

Fig. 1. The external surface of the epitheca, showing a folded and contorted condition of growth.
Lower Pentamerus limestone. *Schoharie, N. Y.*

Figs. 2, 3. The epithecal surface of two specimens, both of which are irregularly infolded and somewhat contorted.
Lower Pentamerus limestone. *Schoharie, N. Y.*

Fig. 4. The inner surface of the epitheca from which the cellules have been removed by exfoliation.
Lower Pentamerus limestone. *Schoharie, N. Y.*

Fig. 5. An enlargement of the preceding, showing the concentric undulations, the finer concentric striæ, and the radiating sharply elevated striæ.

Fig. 7. A portion of the celluliferous face of a specimen, showing the minute cell apertures with irregular low nodes which do not interrupt the continuity of the cells. A portion of the lower part is denuded of the celluliferous crust, and presents the character of the surface shown in fig. 4.
Lower Pentamerus limestone. *Schoharie, N. Y.*

LICHENALIA SERIALIS.

Page 32.

See Plate 13.

Fig. 6. An enlargement from the celluliferous face showing the cell apertures.
Lower Helderberg group. *Clarksville, N. Y.*

LICHENALIA DISTANS.

Page 32.

Fig. 8. A portion of the celluliferous face of a frond, natural size. The right hand portion of the figure represents a broken and macerated fragment of a Dalmanites partially overgrown by a species of Ceramopora.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 9. An enlargement of the above, showing the form and arrangement of the cell apertures.

PALESCHARA ? DISSIMILIS.

Page 35.

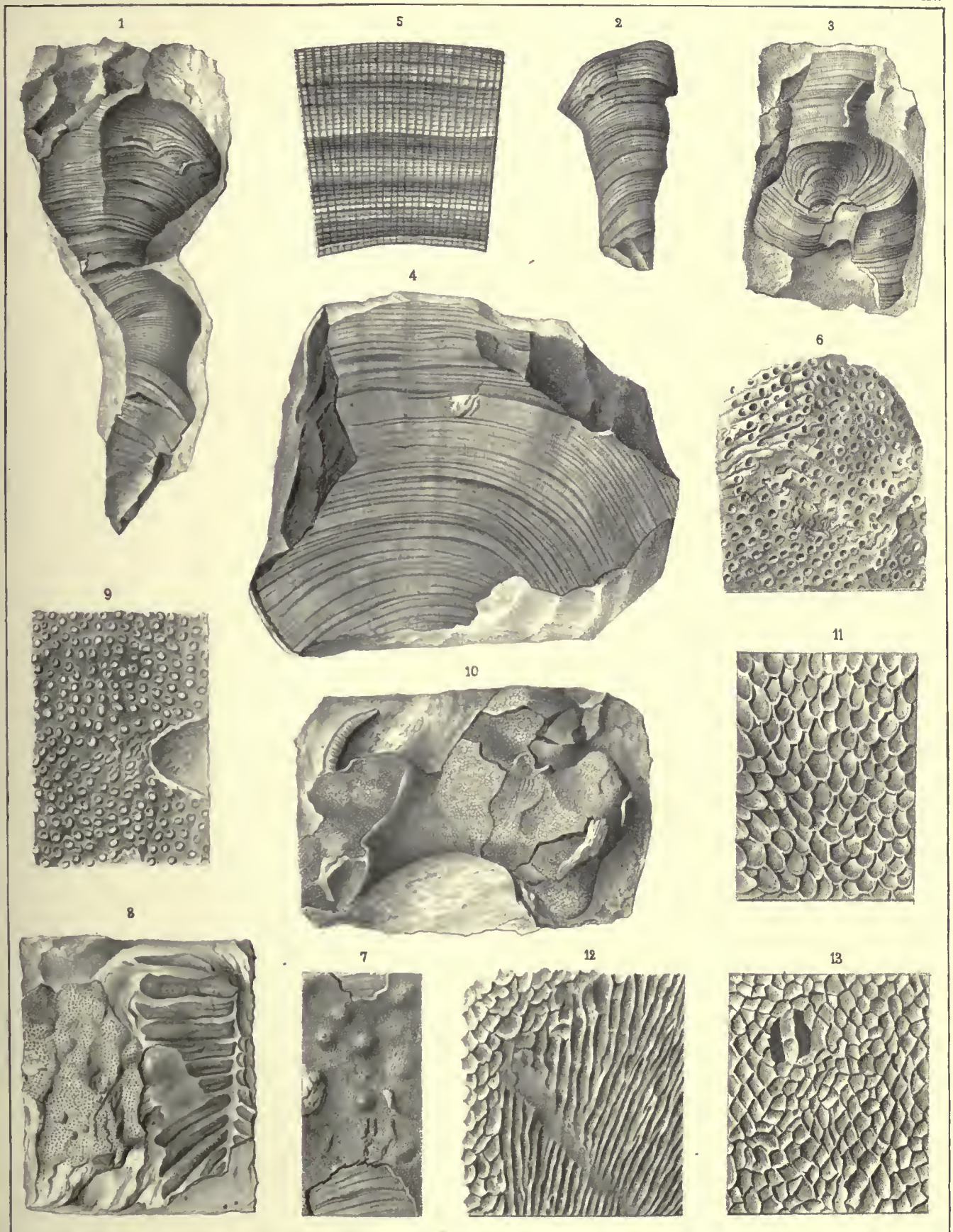
Fig. 10. A portion of a large frond, natural size, showing the mode of growth, cell apertures, etc.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 11. An enlargement from the preceding, showing form of cell apertures.

Fig. 12. An enlargement from another specimen, showing a portion of the surface with the celluliferous part denuded, and preserving long continuous channels with walls of the recumbent cell tubes.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 13. An enlargement from the surface of the same specimen, showing a different form of cell apertures from fig. 11 (possibly representing a distinct species).

LOWER HELDERBERG GROUP.



G.B.Simpson del. H.Bergman lith.

PLATE XVI.

CERAMPORA LABECULOIDEA.

Page 33.

Fig. 1. A frond, natural size, growing on the surface of a Fenestella.

Fig. 2. An enlargement from the surface of the above, showing the form and mode of increase of the cellules.

CERAMPORA? PARVICELLA.

Page 34.

Fig. 3. A frond incrusting a Meristella? showing mode of growth, arrangement of cell apertures, etc., natural size.

Lower Helderberg group. *Clarksville, N. Y.*

Fig. 4. An enlargement from the preceding, showing the form and arrangement of the cellules and form of cell apertures.

CERAMPORA MACULATA.

Page 33.

Fig. 5. The base of a nearly circular form, showing the epitheca.

Fig. 6. The base of a specimen having the epitheca partially removed, showing radiating cell tubes.

Lower Helderberg group. *Clarksville, N. Y.*

Fig. 7. The base of a subelliptical form preserving the epitheca and showing the remains of a Tentaculite on which the zoarium began its growth.

Lower Helderberg group. *Schoharie, N. Y.*

Fig. 8. The base of a large individual preserving the epitheca and showing the point of attachment to some foreign body.

Lower Helderberg group. *Schoharie, N. Y.*

Fig. 9. The celluliferous side, natural size, showing elevated maculæ with larger cells.

Lower Helderberg group. *Schoharie, N. Y.*

Fig. 10. An enlargement of the surface showing form of cell apertures.

Fig. 11. A vertical section showing mode of growth and increase of the cellules.

(*Cerampora* (*Berenicea*) *maxima.*)

Page 34.

Fig. 12. A zoarium, natural size.

PALESCHARA RADIATA.

Page 35.

Fig. 13. A fragment, natural size, growing upon another fossil.

Lower Helderberg group. *Clarksville, N. Y.*

Fig. 14. An enlargement of the surface of the above, showing form and arrangement of the cellules.

PLATE XVI—Continued.

PALESCHARA INCRUSTANS.

Page 35.

Fig. 15. A specimen incrusting the surface of *Spirifera perlamellosa*, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 16. An enlargement from the preceding, contrasting with fig. 14.

Fig. 17. An enlargement from the surface of another specimen, showing slightly larger and more regular arrangement of the cell apertures.

Fig. 18. A Trematapora incrusted with this species.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 19. An enlargement from the preceding, showing the arrangement of cell apertures, which are smaller than in fig. 16.

Fig. 20. A zoarium incrusting *Streptalasma strictum*.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 21. An enlargement from the preceding, showing form and arrangement of cell apertures.

PALESCHARA? (LICHENALIA?) BILATERALIS.

Page 36.

Figs. 22, 23. A fragment of a large frond, natural size, and an enlargement showing cell arrangement; the margins of the cell apertures appear to have been worn away.
Lower Helderberg group. *Clarksville, N. Y.*

PALESCHARA CONCENTRICA.

Page 67.

Fig. 24. An enlargement of a portion of a foliate expansion of this species.
Lower Helderberg group. *Clarksville, N. Y.*

MONOTRYPA? SPINOSULA.

Page 67.

Fig. 25. An enlargement of a portion of the specimen showing the elevated maculæ and unequal cell apertures.
Tentaculite limestone. *Schoharie, N. Y.*

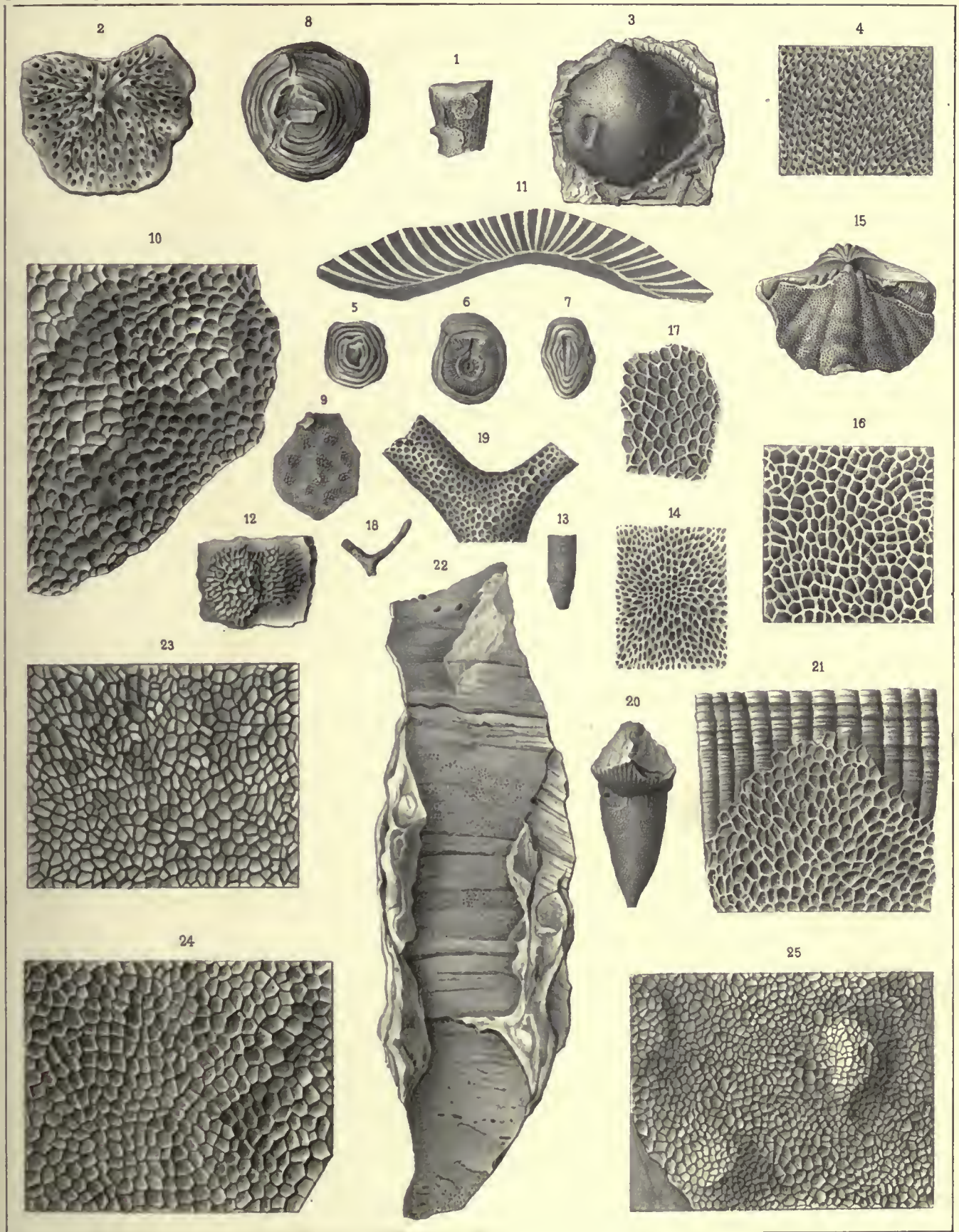

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PLATE XVII.

PTILODICTYA LIRATA.

Page 38.

See Plate 23 A.

Fig. 1. The base of an individual, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. An enlargement from the preceding.

Fig. 3. A fragment of a frond, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 4. An enlargement from the preceding.

RHINODICTYA ? GRANULOSA.

Page 40.

See Plate 23 A.

Fig. 5. A slender stipe, natural size.

Fig. 6. An enlargement of a portion of a stipe.
Lower Helderberg group. *Clarksville, N. Y.*

PTILODICTYA TENUIS.

Page 39.

See Plates 13, 23 A.

Fig. 7. A narrow curving stipe, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 8. An enlargement from the preceding.

Fig. 9. A base of a specimen, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 10. An enlargement of the preceding, showing the minute intercellular pits.

Fig. 11. An enlargement from another specimen, differing somewhat in the size and shape of the cell apertures from figs. 8 and 10.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 12. A longitudinal section, showing origin and mode of growth of the cellules.
Lower Helderberg group. *Clarksville, N. Y.*

PTILODICTYA NEBULOSA.

Page 40.

Fig. 13. An enlargement of a portion of a fragment.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 14. The lower portion of a frond with the base of attachment.
Lower Helderberg group. *Near Catskill, N. Y.*

Fig. 15. An enlargement from the preceding, showing the form and size of cell apertures, and nodes with partially barren spaces.

Fig. 16. An enlargement from another specimen, showing larger cell apertures which are often polygonal; the elevated nodes are larger and are covered with cellules as on the other parts of the frond.
Lower Helderberg group. *Near Catskill, N. Y.*

Fig. 17. An irregular fragment, natural size.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 18. An enlargement, showing polygonal cell apertures and strong nodes on the surface.

LD WER HELDELBERG BRUNE.

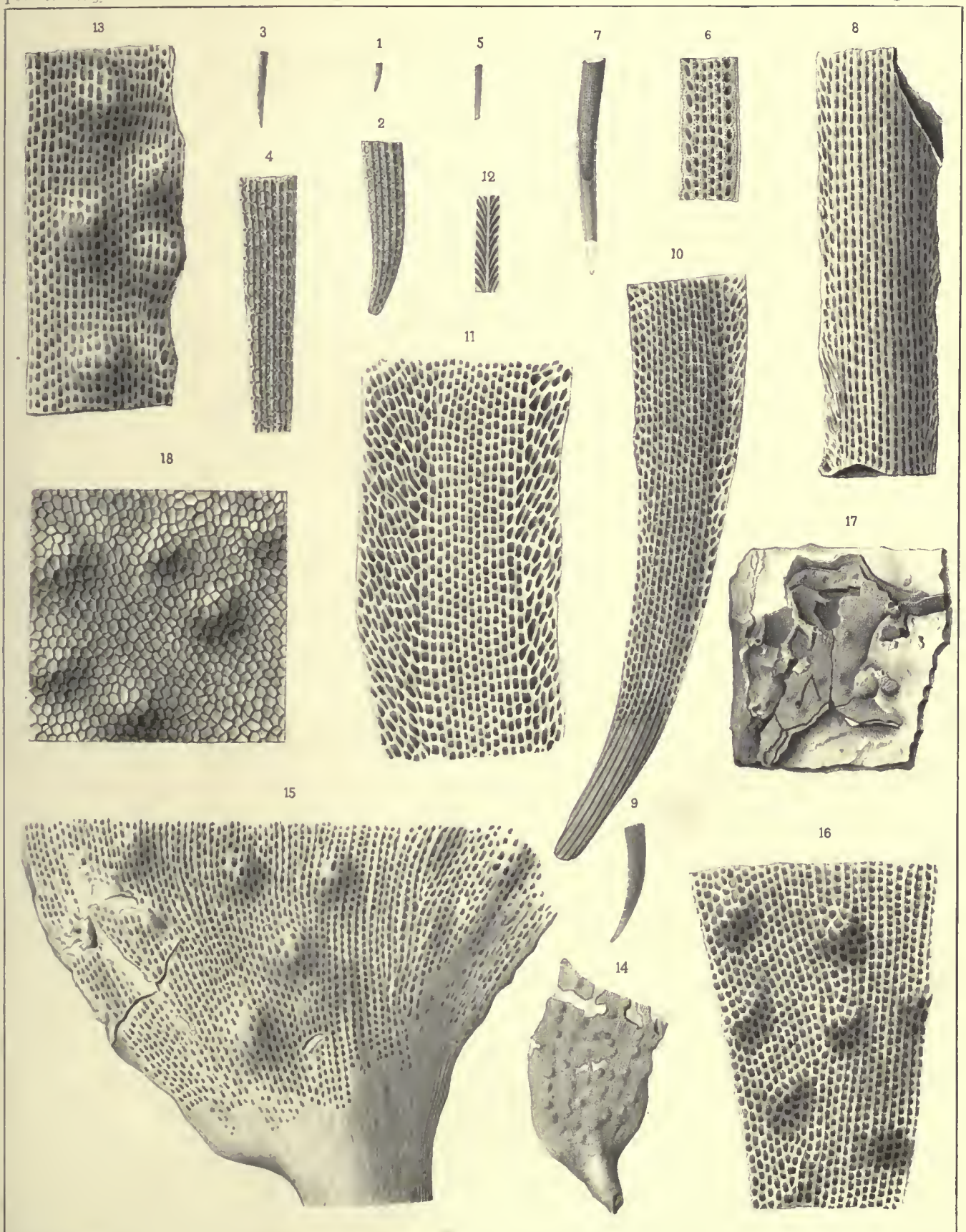

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PLATE XVIII.

Fenestella (Polypora) compacta.

Page 63.

See Plate 22.

Fig. 1. A fragment from near the base of a frond, natural size.
Fig. 2. An enlargement of the surface of the non-celluliferous side.
Fig. 3. An enlargement of a portion of the celluliferous face of the frond.

Fenestella (Polypora) Arta.

Page 63.

Fig. 4. A fragment of a frond, showing a difference in the size of the branches and of the fenestrules on the non-celluliferous side, natural size.
Fig. 5. An enlargement of the non-celluliferous face, with slender branches and large fenestrules.
Fig. 6. The non-celluliferous face of a fragment, natural size.
Fig. 7. An enlargement from the preceding, showing stouter branches and smaller fenestrules than fig. 5.

Fenestella (Polypora) obliqua.

Page 65.

Fig. 8. A fragment of the celluliferous face, natural size.
Fig. 9. An enlargement from the above, showing cell apertures, etc.
Lower Helderberg group. *Near Catskill, N. Y.*

Fenestella (Polypora) paxillata.

Page 65.

Fig. 10. A fragment showing the non-celluliferous face of the frond.
Fig. 11. An enlargement from the above; one branch is decorticated showing the interior structure.
Fig. 12. An enlargement of the celluliferous side of a specimen.
Lower Helderberg group. *Clarksville, N. Y.*

Fenestella (Polypora) sp. indet.

Fig. 13. An enlargement from a fragment worn down from the non-celluliferous face and showing two, three and four ranges of cells.

Fenestella (Polypora) compressa.

Page 61.

Fig. 14. A fragment, natural size, presenting the non-celluliferous face.
Lower Helderberg group. *Clarksville, N. Y.*
Fig. 15. An enlargement from the preceding.
Fig. 16. An enlargement of the non-celluliferous side of a specimen, showing the finely granulose striæ.
Fig. 17. An enlargement from the celluliferous face of a frond, showing the obliquely upward opening of the pores. The surface is modified from weathering.
Lower Helderberg group. *Clarksville, N. Y.*
Fig. 18. An enlargement of the celluliferous face of a fragment, showing the cell apertures opening rectangularly to the axis.
Lower Helderberg group. *Catskill creek, N. Y.*

Fenestella (Polypora) Liliæa.

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Fig. 19. A fragment of the celluliferous face of a frond, natural size.
Fig. 20. An enlargement from the preceding.
Lower Helderberg group. *Clarksville, N. Y.*
Fig. 21. A fragment of a frond, natural size, showing the celluliferous face.
Fig. 22. An enlargement of the preceding.
Lower Helderberg group. *Schoharie, N. Y.*

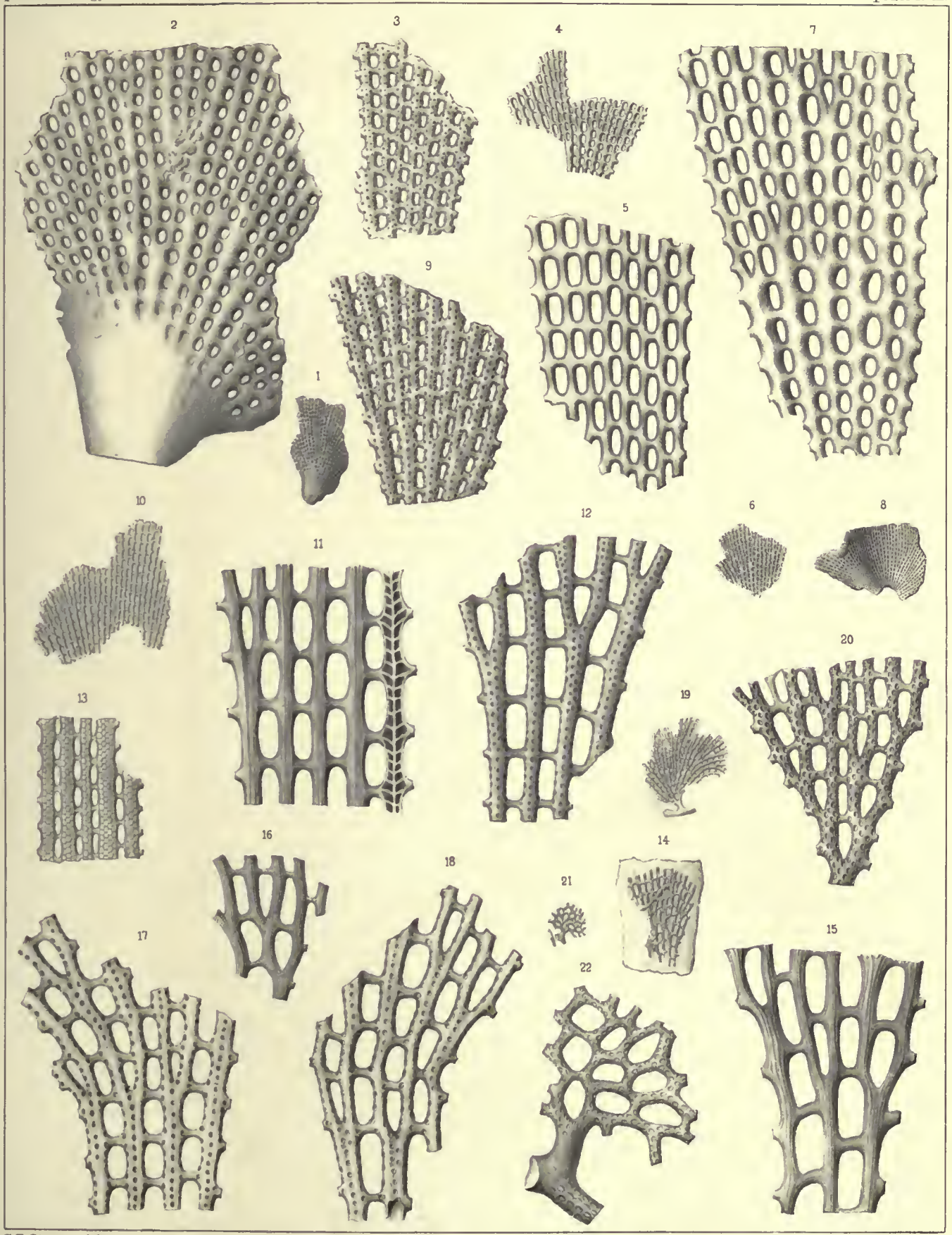
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PLATE XIX.

Fenestella (Polypora) stricta.

Page 59.

Fig. 1. A fragment of a frond, natural size.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. An enlargement of the non-celluliferous face of the preceding.

Fenestella (Polypora) Eudora.

Page 58.

Fig. 3. A fragment of the non-celluliferous face of a frond, natural size.

Fig. 4. An enlargement of the preceding.

Fig. 5. An enlargement of the celluliferous face of a frond, referred to this species with doubt.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 6. A fragment of the non-celluliferous face of the frond.

Fig. 7. An enlargement of the celluliferous face of the preceding, showing smaller cell apertures, which are in some parts more numerous.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 8. A fragment of the non-celluliferous face of a specimen.

Fig. 9. An enlargement from the celluliferous face of the preceding, showing more elongate fenestrules than the above forms.

Fig. 10. An enlargement of the non-celluliferous face of the specimen fig. 8.

Fenestella Æsyle.

Page 46.

Fig. 11. A portion of the frond, natural size, showing the non-celluliferous face.

Fig. 12. An enlargement of the non-celluliferous face, from the preceding.
Lower Helderberg group. *New Salem, N. Y.*

Fig. 13. An enlargement of the non-celluliferous face of another specimen, showing more slender branches and wider fenestrules.

Fenestella (Polypora) Idothea.

Fig. 14. A portion of a frond, natural size, showing the celluliferous face.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 15. An enlargement from the preceding.

Fenestella Spio.

Page 47.

Fig. 16. A portion of the celluliferous face of a frond, enlarged.
Lower Helderberg group. *Clarksville, N. Y.*

Fenestella Althæa.

Page 48.

Fig. 17. An enlargement of the non-celluliferous face of two fragments *a* and *b*, which are probably parts of the same frond.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 18. An enlargement of the non-celluliferous face of another specimen, showing larger fenestrules.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 19. An enlargement of the non-celluliferous face of a fragment from another frond.
Lower Helderberg group. *Clarksville, N. Y.*

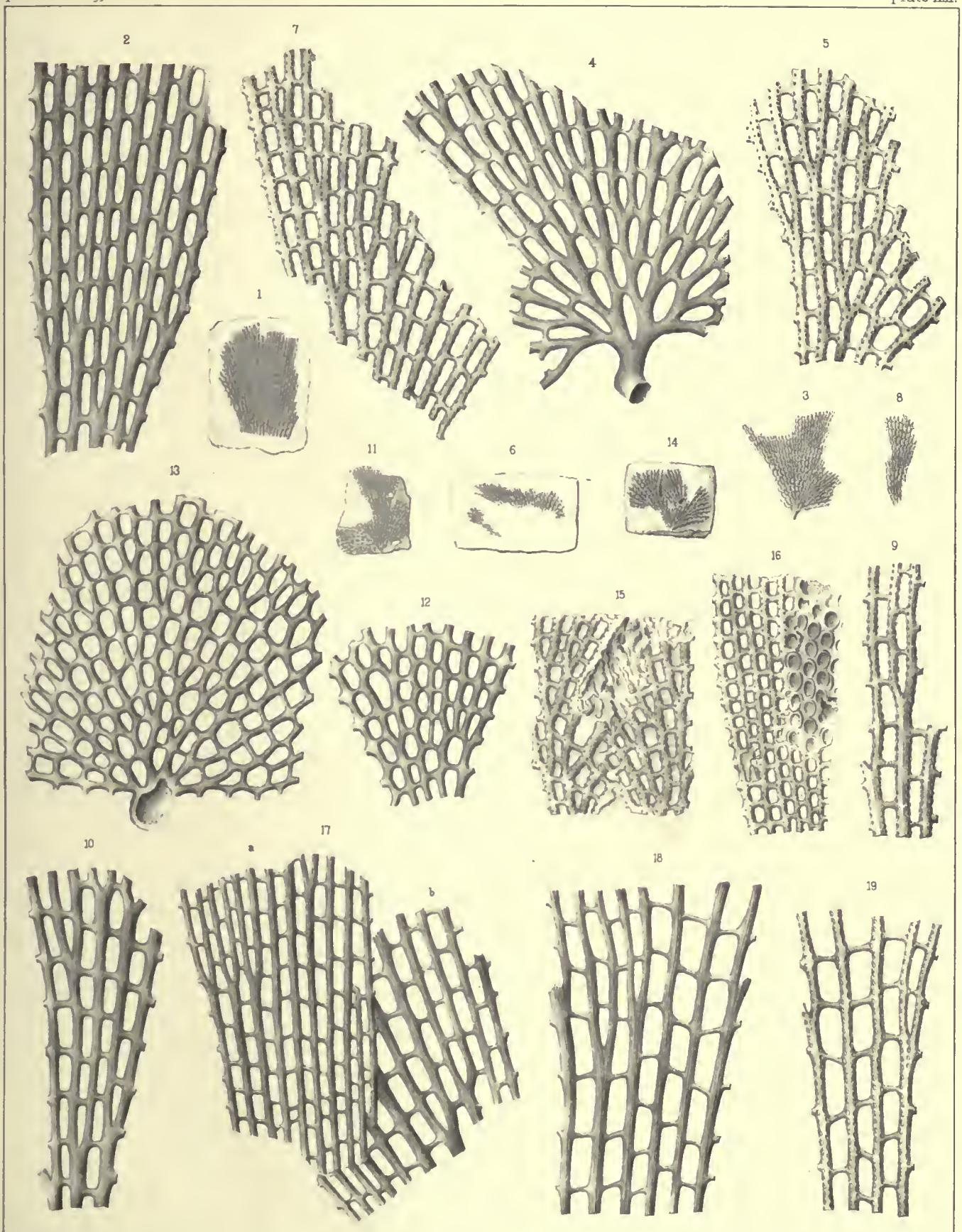
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PLATE XX.

Fenestella crebripora.

Page 43.

Fig. 1. A fragment of the celluliferous face of a frond, natural size.
Fig. 2. An enlargement of the non-celluliferous face of a fragment.
Fig. 3. An enlargement of the celluliferous face of specimen fig. 1.

Lower Helderberg group. *Clarksville, N. Y.*

Fenestella Sylvia.

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Fig. 4. A fragment of the non-celluliferous face of a frond, natural size.
Fig. 5. An enlargement of the non-celluliferous face of the preceding.
Fig. 6. An enlargement from the non-celluliferous face of specimen fig. 4, showing the form of fenestrules, and from three to five lines or striæ on each of the branches, contrasting with fig. 5, from another part of the same frond.
Fig. 7. An enlargement of the celluliferous face from another specimen.

Lower Helderberg group. *Near Clarksville, N. Y.*

Fenestella, sp. ?

Fig. 8. The non-celluliferous face, worn in such a manner as to show the base of the cellules.

Fenestella Philia.

Page 50.

Fig. 9. A fragment of the non-celluliferous face, natural size.
Fig. 10. An enlargement from the preceding.
Fig. 11. An enlargement of the celluliferous face.

Lower Helderberg group. *New Salem, Albany Co., N. Y.*

Fenestella Hestia.

Page 45.

Fig. 12. A fragment of the non-celluliferous face.
Fig. 13. An enlargement of a portion of the preceding, showing pustules and the strongly striated surface of the branches.

Lower Helderberg group. *Schoharie, N. Y.*

Fenestella Cleia.

Page 45.

Fig. 14. An enlargement from the non-celluliferous face of a frond.
Fig. 15. An enlargement of the celluliferous face.

Lower Helderberg group. *Near Clarksville, N. Y.*

Fenestella junceus.

Page 44.

Fig. 16. A fragment of the celluliferous face, natural size.
Fig. 17. An enlargement of the non-celluliferous face of the frond.
Fig. 18. An enlargement of the celluliferous face from the specimen fig. 16.

Lower Helderberg group. *Near Clarksville, N. Y.*

Fenestella Adraste.

Page 48.

Fig. 19. An enlargement from the celluliferous face of a frond.
Fig. 20. A fragment of the non-celluliferous face of a frond, natural size.
Fig. 21. An enlargement from the preceding.
Fig. 22. An enlargement of the celluliferous face of a frond, with an outline section of a branch at the right hand side of the figure.

Lower Helderberg group. *Near Clarksville, N. Y.*

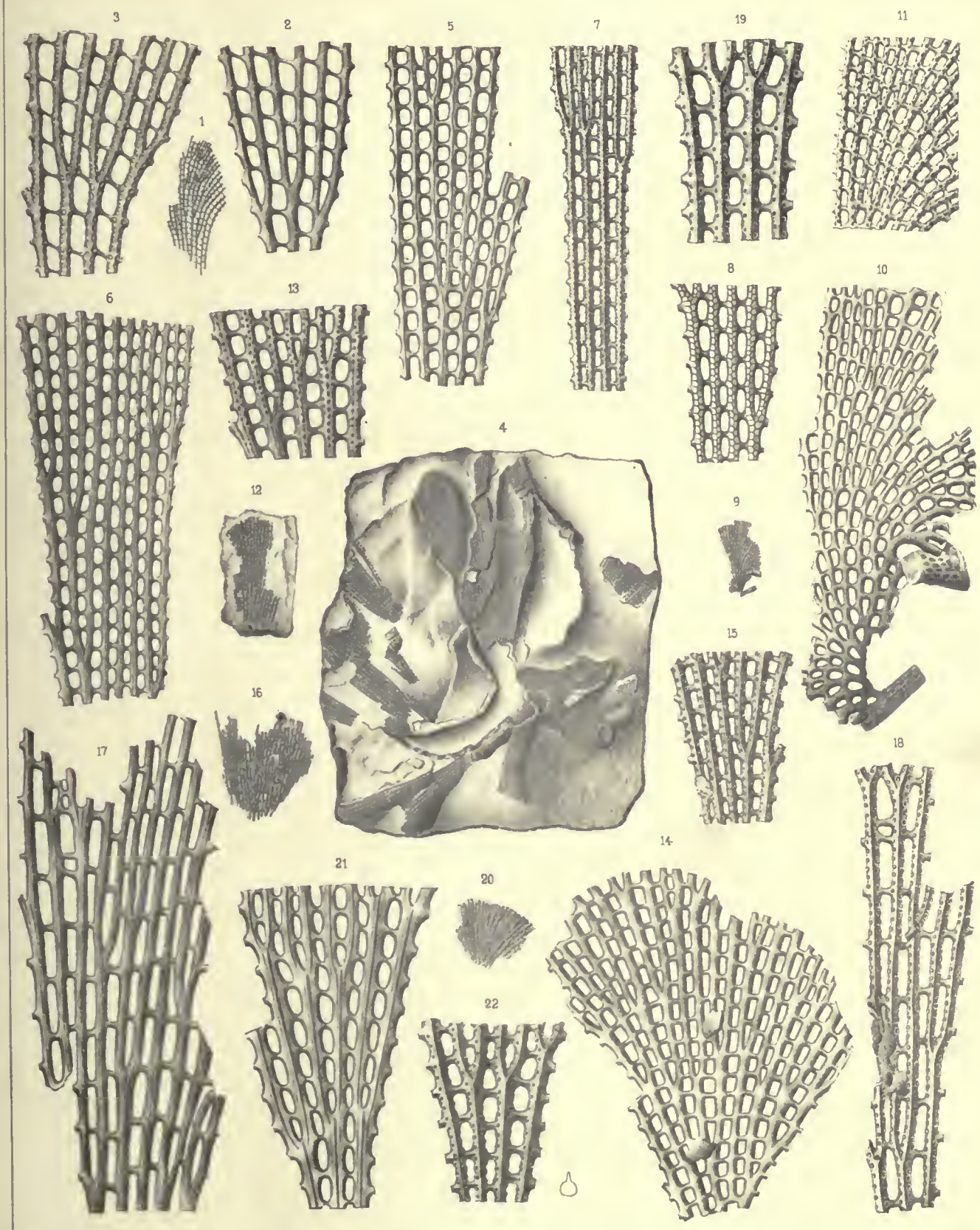
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PLATE XXI.

Fenestella Thyene.

Page 50.

Fig. 1. A fragment of the non-celluliferous face of a frond, natural size.
Fig. 2. An enlargement from the preceding.
Fig. 3. An enlargement of the non-celluliferous face showing more slender branches.
Lower Helderberg group. *Schoharie, N. Y.*
Fig. 4. An enlargement of the celluliferous face with an outline section of a branch at the left hand of the figure.
Fig. 5. A large funnel-shaped frond, natural size.
Lower Helderberg group. *Schoharie, N. Y.*

Fenestella Idalia.

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Fig. 6. The non-celluliferous face of a funnel-shaped frond, natural size.
Fig. 7. An enlargement of the non-celluliferous face.
Lower Helderberg group. *Clarksville, N. Y.*
Fig. 8. An enlargement of the non-celluliferous face showing slender striate branches.
Fig. 9. An enlargement of the non-celluliferous face of a frond, with stouter branches.

Fenestella Coronis.

Page 51.

Fig. 10. A fragment of the non-celluliferous face of a frond, natural size.
Fig. 11. An enlargement of the non-celluliferous face showing the thickened base, and the entire surface free from striæ.
Fig. 12. An enlargement from the non-celluliferous face. The upper part of the figure, from the outer extension of the frond, shows elongate fenestrules and strongly striate granulose branches.
Fig. 13. An enlargement from the celluliferous face of the specimen fig. 11.
Lower Helderberg group. *Near Clarksville, N. Y.*

Fenestella (Unitrypa) præcursor.

Page 54.

Fig. 14. An enlargement of the non-celluliferous face of a frond.
Fig. 15. An enlargement of the celluliferous face, showing the carinate branches, with the carinæ expanded above and covering the cell apertures, except in the upper part of the figure where they have been removed.
Fig. 16. An enlargement of the celluliferous face, with the carinæ removed, exposing the cell apertures.
Fig. 17. An enlargement showing the alate carinæ, which in some parts are united by the extension of the marginal nodes into slender connecting bars.
Fig. 18. An enlargement from the ends of the branches showing the form of the carinæ with their lateral expansions.
Lower Helderberg group. *Near Clarksville, N. Y.*

Fenestella quadrula.

Page 53.

Fig. 19. A fragment of the non-celluliferous face of a frond, natural size.
Fig. 20. An enlargement from the preceding.
Fig. 21. An enlargement of the celluliferous face with the carinæ broken off, leaving the branches apparently grooved.
Fig. 22. An enlargement of the celluliferous face, showing the presence of the alate carinæ with the marginal crenulations.
Lower Helderberg group. *Near Clarksville, N. Y.*

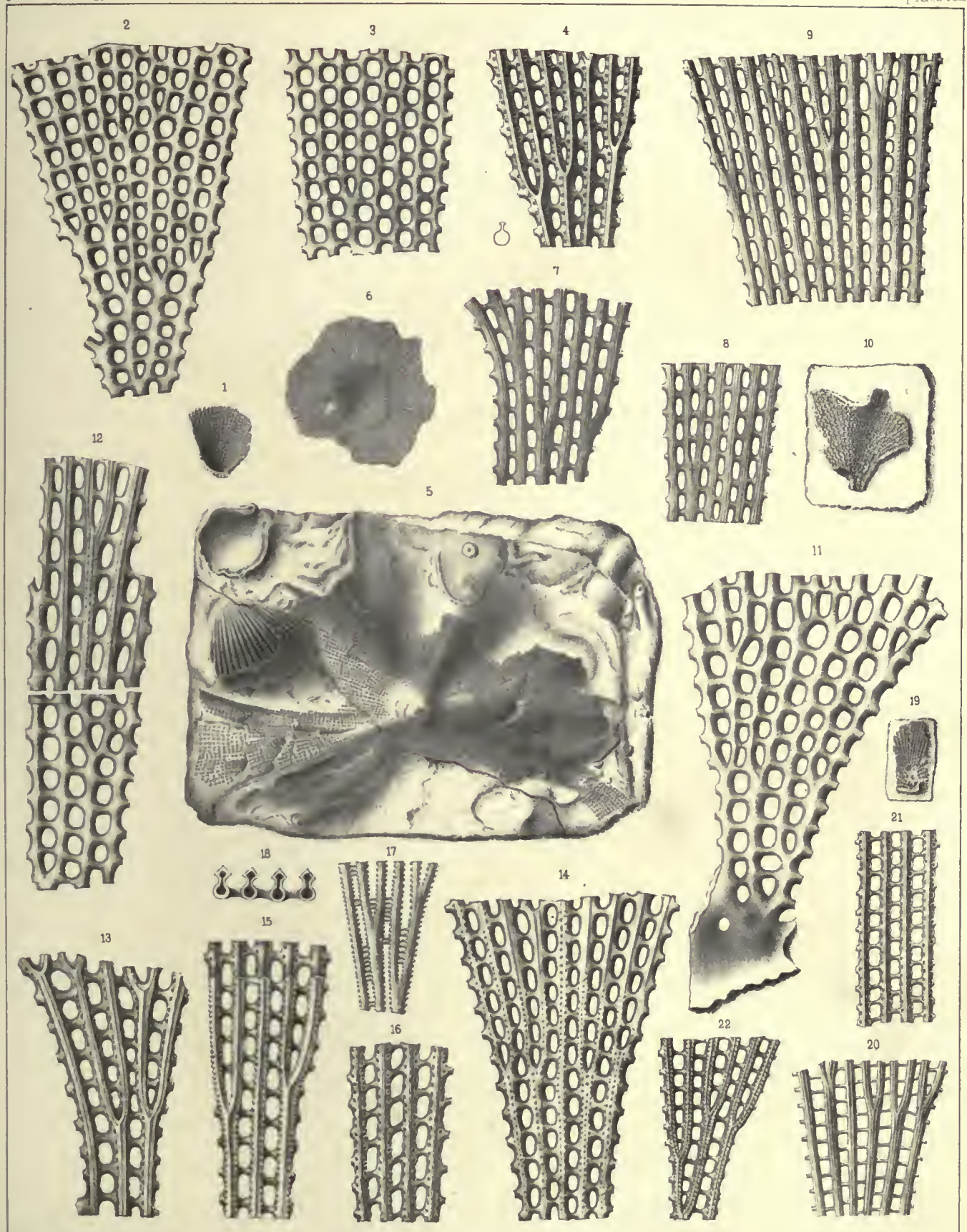
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PLATE XXII.

Fenestella (Unitrypa) Nervia.

Page 55.

Fig. 1. The celluliferous face of a funnel-shaped frond.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. An enlargement of the preceding, showing the cell apertures, with a portion of the surface exfoliated, disclosing the interior structure, cell walls, etc.

Fig. 3. An enlargement from the celluliferous face of specimen fig. 1, where the carinal crests are extended into lateral bars, meeting those from the opposite side.

Fig. 6. An enlargement from the celluliferous face of another specimen.

Fig. 9. A fragment; natural size, showing the extension of the lateral bars connecting the intercellular carinæ.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 10. An enlargement of the preceding.

Fenestella (Polypora) compacta.

Page 63.
See Plate 18.

Fig. 4. The non-celluliferous face of a fragment.

Fig. 5. An enlargement from the preceding.
Lower Helderberg group. *Clarksville, N. Y.*

Fenestella adornata.

Page 66.

Fig. 7. An enlargement of the non-celluliferous face.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 8. An enlargement of the celluliferous face of the preceding.

Fenestella (Unitrypa) Nervia, var. constricta.

Page 56.

Fig. 11. An enlargement of the non-celluliferous face, showing the thickened granulated branches and small fenestrules.

Fig. 12. An enlargement from the celluliferous face of the preceding specimen, showing the thickened inter-cellular crests and connecting bars on a part of the surface.

Fenestella (Hemitrypa) biserialis.

Page 57.

Fig. 13. The base of the celluliferous side of a funnel-shaped frond, natural size.

Fig. 16. An enlargement of the non-celluliferous face of another specimen.

Fig. 17. An enlargement of the celluliferous face from the specimen fig. 13, where the elevated crests of the intercellular carinæ are broken off showing the cell-apertures.

Fig. 18. An enlargement from the celluliferous side of specimen fig. 13, preserving the elevated crests of the carinæ, and the lateral processes uniting in a longitudinal bar.
Lower Helderberg group. *Near Clarksville, N. Y.*

Fenestella (Hemitrypa) biseralis, var. exilis.

Page 57.

Fig. 14. A sectional view enlarged, showing the elevation of the intercellular crests and the connecting processes. (× 4.)

Fig. 15. An enlargement from the non-celluliferous face of a specimen.
Lower Helderberg group. *Near Clarksville, N. Y.*

ICHTHYORACHIS NEREIS.

Page 66.

Fig. 19. A fragment of a frond, natural size.
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 20. An enlargement of the specimen fig. 19.

Fig. 21. An enlargement of the celluliferous side of another specimen.

SYNOCLADIA? sp.

Fig. 22. The non-celluliferous face of a fragment of undetermined relations.

TREMATOPORA? indet.

Fig. 23. A fragment, natural size. Introduced on this plate in error, and previously referred to the following species.

THAMNISCUS? CISSEIS.

Page 42.

Fig. 24. A piece of rock with several fragments of the fossil on its surface.

Fig. 25. This species associated, on a piece of rock, with other species of Bryozoa and Aulopora.

Fig. 26. A branching frond, natural size.

Fig. 27. A fragment enlarged; the branch is twisted showing both the striate non-celluliferous side and a portion of the celluliferous surface.

Fig. 28. An enlargement of the striated surface of a branch.

Fig. 29. An enlargement of the celluliferous face of a branchlet, showing, in some parts, granulose cell margins, with some intermediate pustules or short spinules.

Fig. 30. The celluliferous face, partially worn, and with more circular apertures.
Lower Helderberg group. *Near Clarksville, N. Y.*

THAMNISCUS? NYSA.

Page 43.

Figs. 31, 32. A branching fragment and an enlargement from the same.

Fig. 47. A fragment, natural size.

Fig. 48. An enlargement of the preceding.
Lower Helderberg group. *Clarksville, N. Y.*

THAMNISCUS FRUCTICELLA.

Page 42.

Fig. 33. The non-celluliferous face of a branching form.

THAMNISCUS VARIOLATA.

Page 41.

Fig. 34. A portion of a frond, natural size.

Fig. 35. A fragment showing a striated surface with cells on the margins of the branchlets.

Fig. 36. The celluliferous face of a larger frond.

Fig. 37. The non-celluliferous face of an unusually large frond, showing cells on the margins of the branchlets.

Fig. 38. The non-celluliferous side of a fragment with closely-crowded branchlets.

Fig. 39. A fragment showing the smaller extremities of the branchlets.

Figs. 40, 41. Two fragments showing the characters of the frond near its base.

Fig. 42. A transverse section of a branch, showing numerous cellules.

Fig. 43. An enlargement of the cell tubes, as seen looking upon the lateral margin of a branch.

Fig. 44. An enlargement from the celluliferous face of a branch and branchlets, showing the irregular distribution of the cellules.

Fig. 45. An enlargement from the specimen fig. 36, showing the celluliferous face and a part of the striated surface.

Fig. 46. An enlargement of an irregularly-branching specimen, showing unequally distributed cell openings.
Lower Helderberg group. *Near Clarksville, N. Y.*

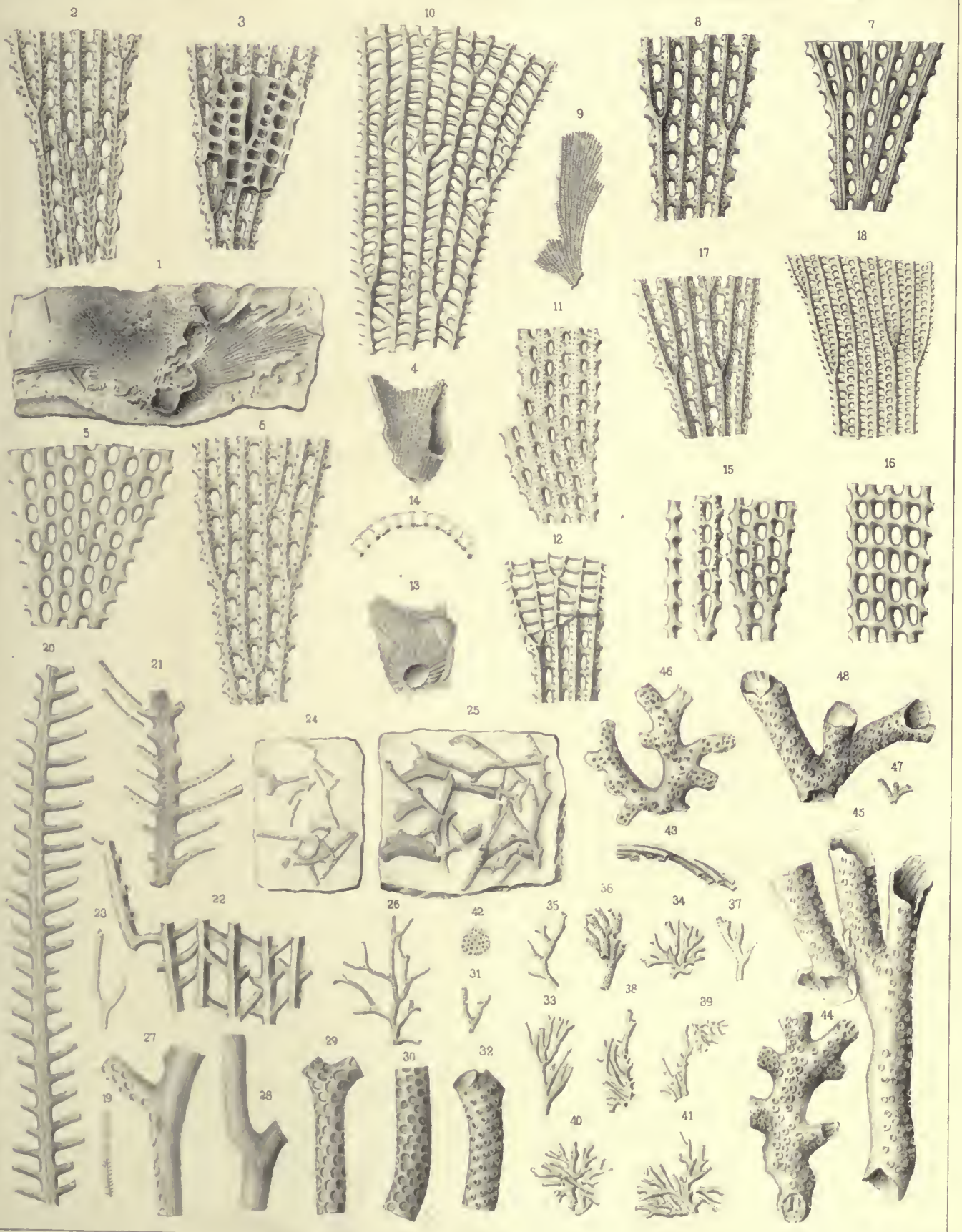
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PLATE XXIII.

TREMATOPORA (ORTHOPORA) REGULARIS.

Page 16.
See Plates 11 and 13.

Fig. 1. An enlargement of a portion of a specimen showing the cell apertures obscured by the prominent, nodose longitudinal ridges. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

TREMATOPORA (ORTHOPORA) GRANILINEA, n. sp.

Fig. 2. An enlargement of a portion of a specimen, showing the form and arrangement of the cell apertures, the nodes and granulose striations of the surface. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

CALLOPORA (CALLOTRYPA) HETEROPORA.

Page 25.
See Plates 11 and 13.

Fig. 3. An enlargement of a portion of a specimen, showing the form and arrangement of the cell apertures and mesopores. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

FISTULIPORA, sp.?

See Plate 14.

Fig. 4. An enlargement of a portion of the surface, showing the form and arrangement of the cell apertures and mesopores. (× 18.)

TREMATOPORA (ORTHOPORA) OVATIPORA.

Page 17.
See Plate 11.

Fig. 5. An enlargement of a specimen, showing the form and arrangement of the cell apertures, their granulose margins, the node at the base of each aperture and the nodose longitudinal ridges separating the ranges of apertures. (× 18.)
Lower Helderberg group. *New Salem, Albany Co., N. Y.*

CALLOPORA (CALLOTRYPA) OCCULIFERA.

Page 27.
See Plate 13.

Fig. 6. An enlargement showing the form and arrangement of the cell apertures and mesopores. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

TREMATOPORA (ORTHOPORA) PARALLELA.

Page 19.
See Plate 11.

Fig. 7. An enlargement showing the peristomes in contact and a pominent node at each angle. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 8. An enlargement showing the longitudinal ranges of apertures separated by nodose ridges. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

TREMATOPORA (ORTHOPORA) CANALICULATA.

Page 17.
See Plate 11.

Fig. 9. An enlargement showing the form and arrangement of the cell apertures. (× 18.)
Lower Helderburg group. *New Salem, Albany Co., N. Y.*

PLATE XXIII—Continued.

Trematopora (Orthopora) nodosa, n. sp.

Fig. 10. An enlargement showing the form and arrangement of the cell apertures, their slightly elevated margins and the prominent nodes. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

Trematopora (Orthopora) rhombifera.

Page 18.
See Plate 11.

Fig. 11. An enlargement of a specimen, the surface of which has been somewhat weathered.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 12. An enlargement showing prominent nodes at the angles of the vestibular areas.
Lower Helderberg group. *Clarksville, N. Y.*

Callopora (Callotrypa) striata.

Page 26.
See Plate 11.

Fig. 13. An enlargement showing the form and arrangement of the cell apertures, the prominent node at the base of each aperture, and the mesopores so arranged that their margins have the appearance of longitudinal striations. (× 18.)
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 14. An enlargement showing the cell apertures with slightly elevated margins, without nodes. The mesopores appear simply as interrupted striations. (× 18.)
Lower Helderberg group. *Schoharie, N. Y.*

Callopora (Callotrypa) macropora.

Page 24.
See Plate 11.

Fig. 15. An enlargement showing the oval cell apertures with their equally elevated margins, which are frequently in contact. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 16. An enlargement showing cell apertures without elevated margins. The surface between the apertures is elevated, angular and with few mesopores.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 17. An enlargement showing the margins of the cell apertures distinctly and equally elevated and with two or three ranges of mesopores between adjacent cell apertures. (× 18.)
Lower Helderberg group. *Slingerland's Creek near Clarksville, N. Y.*

Fig 18. An enlargement showing the cell apertures without elevated margings. Interapertural space elevated, rounded and with moderately prominent nodes. Mesopores few and often obsolete over a portion of the specimen.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 19. An enlargement showing the cell apertures polygonal in form, from mutal pressure and with conspicuous mesopores. The peristomes are thin and strongly and equally elevated. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

Trematopora ? (Trematella ?) corticosa.

Page 15.
See Plates 10 and 13.

Fig. 20. An enlargement showing regularly oval cell apertures. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

Callopora (Callotrypa) paucipora, n. sp.

Fig. 21. An enlargement showing the form and arrangement of the cell apertures, the scattered mesopores and nodes.
Lower Helderberg group. *Clarksville, N. Y.*

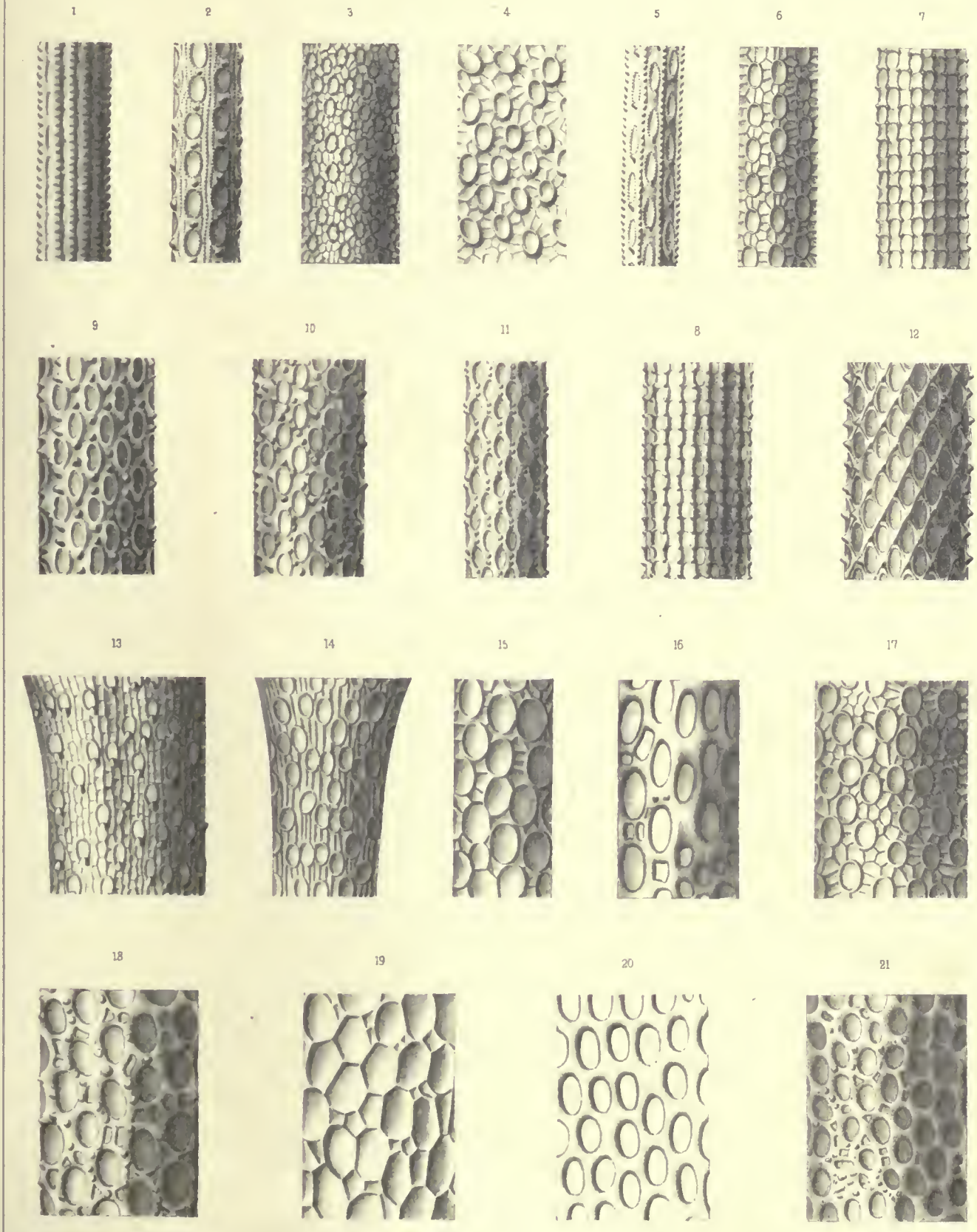

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PLATE XXIII A.

CALLOPÓRA (CŒLOCAULIS) VENUSTA.

Page 23.

See Plate 12.

Fig. 1. An enlargement showing the form and arrangement of the cell apertures, and their strongly elevated, and inflated margins. The mesopores are obsolete. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 2. An enlargement showing the form and arrangement of the cell apertures with thin slightly elevated margins. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 3. An enlargement showing the cell apertures distant from each other, irregularly disposed and with usually a single row of mesopores between adjacent apertures. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 4. An enlargement showing irregularly disposed cell apertures and numerous prominent nodes on the elevated peristomes.
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 5. An enlargement showing irregularly disposed cell apertures and comparatively large mesopores. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

CALLOPORA CELLULOSA.

Page 21.

See Plates 12 and 13.

Fig. 6. An enlargement showing irregularly disposed, distant cell apertures and numerous comparatively small mesopores. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

DIAMESOPORA CONSTRICTA.

Page 19.

See Plate 10.

Fig. 7. An enlargement showing the form of the cell apertures. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

FISTULIPORA PONDEROSA.

Page 27.

See Plate 14.

Fig. 8. An oblique view of a specimen, showing the conical form of the nodes of the surface. (× 18.)
Lower Helderberg group. *Schoharie, N. Y.*

Fig. 9. An enlargement showing the appearance of a specimen when the surface has been worn or marcerated. (× 18.)
Lower Helderberg group. *Catskill creek, near Catskill, N. Y.*

Fig. 10. An enlargement of a portion of the surface of a well preserved specimen, showing the form and arrangement of the cell apertures, the mesopores and the numerous prominent conical nodes. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

CALLOPORA (CŒLOCAULIS) MEDIOPORA.

Page 23.

See Plate 14.

Fig. 11. An enlargement showing elongate oval cell apertures and mesopores which are frequently equal in size to the cell apertures. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 12. An enlargement showing larger and more broadly oval cell apertures than in the preceding figure, with minute mesopores and small spines on the elevated margins of the apertures and mesopores. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

Fig. 13. An enlargement showing small cell apertures which are sometimes nearly circular, and the mesopores which are sometimes larger than the apertures. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

CALLOPORA PERELEGANS.

Page 22.
See Plate 12.

Fig. 14. An enlargement of a portion of the surface of a specimen, showing the form of the cell apertures and mesopores. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

PTILODICTYA TENUIS.

Page 39.
See Plates 13 and 17.

Fig. 15. An enlargement showing the appearance of the cell apertures near the margin of a specimen. (× 18.)
Lower Helderberg group. *Klingerland's creek, near Clarksville, N. Y.*

STICTOPORA PAPILLOSA.

Page 57.
See Plate 13.

Fig. 16. An enlargement showing the form and arrangement of the papillose cell apertures. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

STICTOPORA GRANATULA.

Page 38.
See Plate 11.

Fig. 17. An enlargement of a portion of the surface of a specimen, showing the form and arrangement of the cell apertures, with the thin, slightly elevated granulose peristomes. (× 18.)
Lower Helderberg group. *Catskill creek, N. Y.*

RHINODICTYA? GRANULOSA.

Page 40.
See Plate 17.

Fig. 18. An enlargement of a portion of a specimen showing the form and arrangement of the cell apertures and the numerous granules of the surface. (× 18.)
Lower Helderberg group. *Catskill creek, N. Y.*

Fig. 19. An enlargement of a portion of a very slender specimen, showing the form and arrangement of the cell apertures and the conspicuous granules of the surface. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

PTILODICTYA LIRATA.

Page 38.
See Plate 17.

Fig. 20. An enlargement of a portion of a specimen, showing the form and arrangement of the cell apertures and the minute triangular pits thin. (× 18.)
Lower Helderberg group. *Schoharie, N. Y.*

STICTOPORA ALTERNATA, n. sp.

Fig. 21. An enlargement showing the form and arrangement of the cell apertures, and the elevated interapertural area. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

STICTOPORA OBSOLETA.

Page 37.

Fig. 22. An enlargement of a portion of a specimen, showing the form and arrangement of the cell apertures and the wide non-celluliferous margin. (× 18.)
Lower Helderberg group. *Clarksville, N. Y.*

LOWER HELDERBERG GROUP.

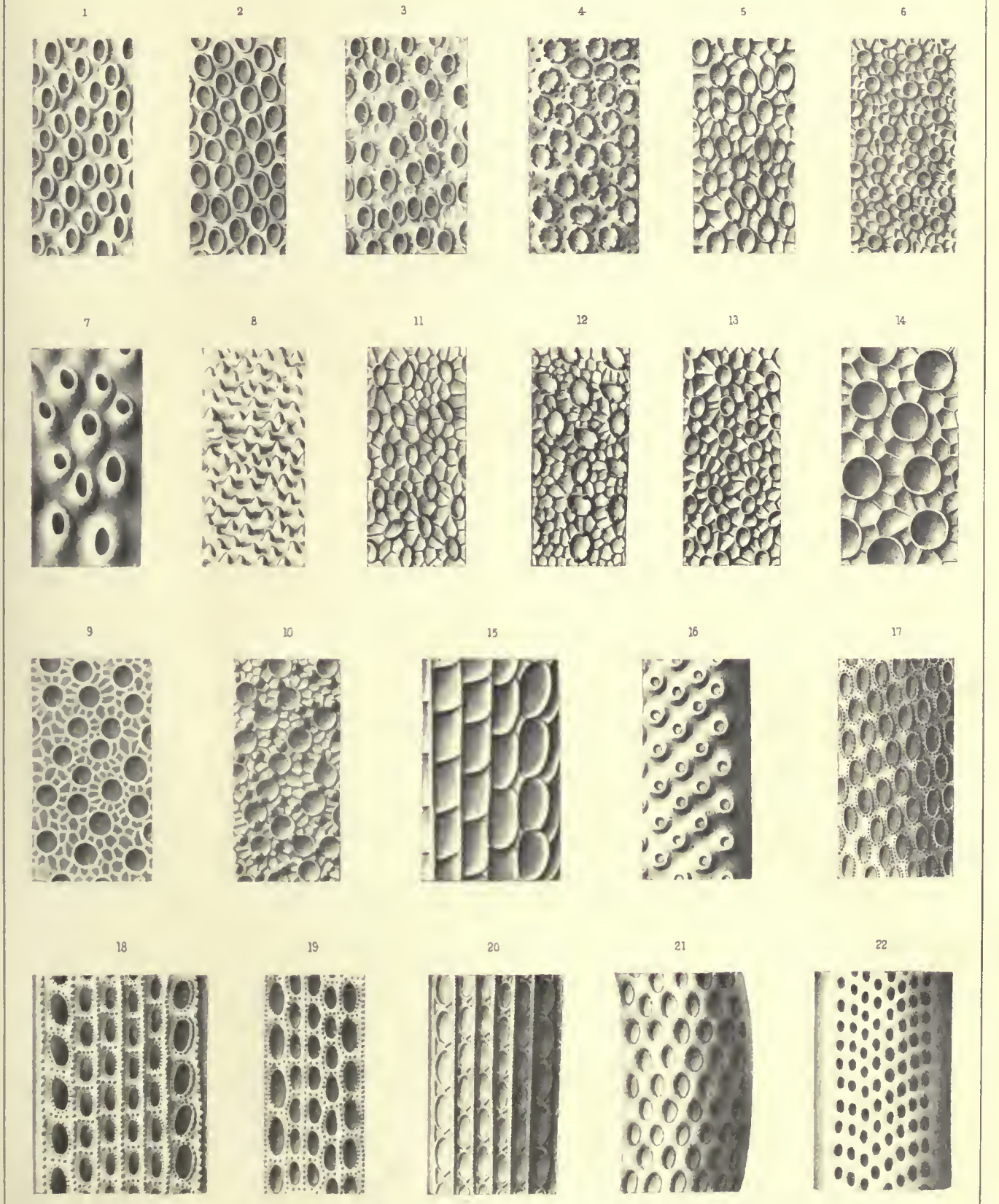

PLATE XXIV.

Ischadites squamifer.

Page 290.

Fig. 1. A lateral view of the type specimen. The base is imperfect.

Fig. 2. A portion of the zonal surface enlarged, showing the imbricating appearance of the summit plates of the spicules.

Lower Helderberg group. *Schoharie, N. Y.*

Receptaculites infundibuliformis.

Page 289.

Fig. 3. A lateral view of a small silicified specimen.

Lower Helderberg group. *Clarksville, N. Y.*

Fig. 4. *Id.* The upper side, showing the arrangement of the summit plates.

Fig. 5. *Id.* An enlargement, showing a division of two of the vertical spicules, and the angular cavities left by the solution of the summit plates.

Fig. 6. *Id.* An oblique view of a portion of the surface, showing the spiniferous ridges of the specimen.

Fig. 7. *Id.* Similar to the preceding, but vertical to the surface.

Fig. 8. The summit of a larger specimen.

Fig. 9. The broken edge of the preceding, showing the cavities left by the vertical spicular rays.

Fig. 10. A large specimen which has been macerated, compressed, and the substance of the sponge removed.

Lower Helderberg group. *Clarksville, N. Y.*

Fig. 11. A section similar to fig. 9, from a thin lenticular specimen.

Lower Helderberg group. *Clarksville, N. Y.*

Ischadites bursiformis.

Page 290.

Fig. 12. A lateral view of a large compressed specimen, preserving the impress of the calyces of three cyathophylloid corals.

Schoharie grit. *Clarksville, N. Y.*

Fig. 13. A small discoid compressed specimen with eccentric apex.

Fig. 14. A fragment, showing a different condition of weathering.

Schoharie grit. *Schoharie, N. Y.*

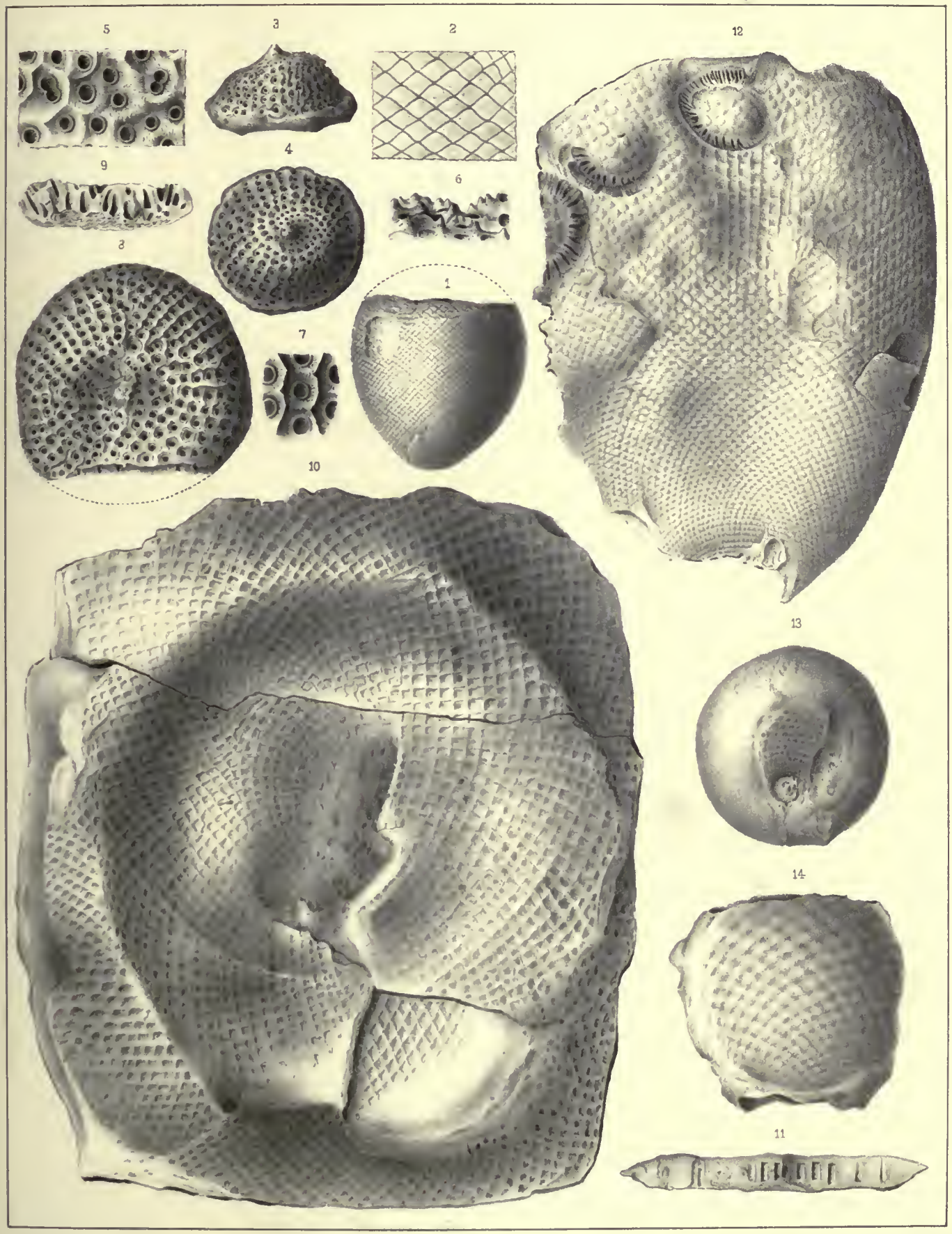
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PLATE XXV.

CALLOPORA GENICULATA.

Page 75.

Fig. 1. A specimen, natural size, showing form and mode of growth.
Upper Helderberg group. *Ontario, Canada.*

Fig. 2. An enlargement of a portion of the preceding, showing the form and arrangement of the cell apertures and intermediate pits. (× 6.)

Fig. 3. The interior of the same, showing the form and manner of growth of the cell tubes.

TREMATOPORA (TREMATELLA) GLOMERATA.

Page 70.

Fig. 4. A specimen, natural size, showing form and mode of growth.
Upper Helderberg group.

Fig. 5. A portion of a branch enlarged, showing the form and arrangement of the cell apertures and ornamentation of the inter-apertural space. (× 18.)

CALLOPORA MULTISERIATA.

Page 75.
See Plate 26.

Fig. 6. A fragment, natural size.
Upper Helderberg group. *Near Leroy, Genesee Co., N. Y.*

Fig. 7. A portion of the preceding, enlarged, showing the form and arrangement of the cell apertures and intermediate pits. (× 18.)

ACANTHOCLEMA ALTERNATUM.

Page 72.

Fig. 8. A fragment of a specimen, natural size, showing the form and mode of growth.
Upper Helderberg group. *Onondaga Valley, N. Y.*

Fig. 9. A portion of the preceding, enlarged, showing the surface characters, the form and arrangement of the cell apertures, the alternating nodes and longitudinal ridges. (× 6.)

Fig. 10. A portion of the same still further enlarged, showing more distinctly the characters represented in fig. 9. (× 18.)

LICHENALIA (LICHENOTRYPA) LONGISPINA.

Page 287.

Fig. 11. A portion of the surface, showing the form and arrangement of the cell apertures, the partitions with spines at the angles. (× 6.)
Upper Helderberg group. *Falls of the Ohio river.*

Fig. 12. A portion of the same, showing the form of the cell apertures before the formation of the dividing walls. (× 18.)

LICHENALIA (SELENOPORA) CIRCINCTA.

Page 86.

Fig. 13. A specimen, natural size, encrusting *Polypora cultellata.*
Upper Helderberg group. *Falls of the Ohio river.*

Fig. 14. A portion of the surface of the same, showing one of the maculæ and adjacent cell apertures. (× 6.)

Fig. 15. A portion of the surface, showing more distinctly the form and arrangement of the cell apertures, the lunate denticulations of the peristomes and the elevations separating them. (× 18.)

TREMATOPORA (TREMATELLA) ARBOREA.

Page 69.

Figs. 16, 17, 18, 20. Four specimens, natural size, showing variation in the mode of growth and method of branching.
Upper Helderberg group. *Falls of the Ohio river.*

Fig. 19. An enlargement of a portion of fig. 18, showing oval cell apertures, and areas destitute of apertures, with the lower portion of the surface spinulose. (× 6.)

Fig. 21. A portion of fig. 20 enlarged, showing distinct annulations, the apertures obscured by abrasion and a portion of the surface granulose.

Fig. 24. The base of a frond, probably of *T. arborea.*

PLATE XXV—Continued.

TREMATOPORA (TREMATELLA) ANNULATA.

Page 69.

See Plate 26.

Fig. 22. A specimen, natural size.

Upper Helderberg group. *Falls of the Ohio river.*

Fig. 23. A portion of the surface of the preceding, showing the polygonal and closely arranged cell apertures. (× 18.)

TROPIDOPORA NANA.

Page 71.

Fig. 25. A specimen, natural size, associated with *Aulopora* and *Fenestella*.

Fig. 26. A portion (× 18) showing the form and arrangement of the cell apertures and the undulating longitudinal ridges.

Upper Helderberg group.

TREMATOPORA (ORTHOPORA) REGULARIS.

Page 91.

See Plates 11, 13, 23 and 26.

Fig. 27. A fragment, natural size.

Fig. 28. A portion (× 6) showing rows of granules between the cell apertures.

Upper Helderberg group. *Falls of the Ohio river.*

TREMATOPORA (ORTHOPORA) RHOMBIFERA.

Page 71.

See Plates 11, 23 and 26.

Fig. 29. A specimen, natural size, showing an unusual mode of branching.

Upper Helderberg group. *Falls of the Ohio river.*

NEMATAXIS FIBROSUS.

Page 74.

Fig. 30. A specimen, natural size, imbedded in the rock, and fractured so as to show the internal structure and also the mode of branching.

Upper Helderberg group.

Fig. 31. A portion of another specimen. The cell apertures are obsolete and the surface is marked by broad, somewhat irregular, longitudinal striations. (× 6.)

Upper Helderberg group.

Fig. 32. A portion of the surface of another specimen, presenting characters similar to those in fig. 31, but having finer and more regular striations. (× 6.)

Upper Helderberg group.

Fig. 33. A portion of a specimen broken below and showing the angular cell tubes. (× 6.)

Upper Helderberg group.

Fig. 34. A portion of a specimen, showing the oval cell apertures arranged in regular longitudinal rows and maculæ destitute of cell apertures. (× 6.)

Upper Helderberg group.

Fig. 35. A portion of fig. 30, showing the cell tubes and the fibrous structure near the surface.

Fig. 36. A portion of the interior of a specimen, showing the direction of the cell tubes. (× 6.)

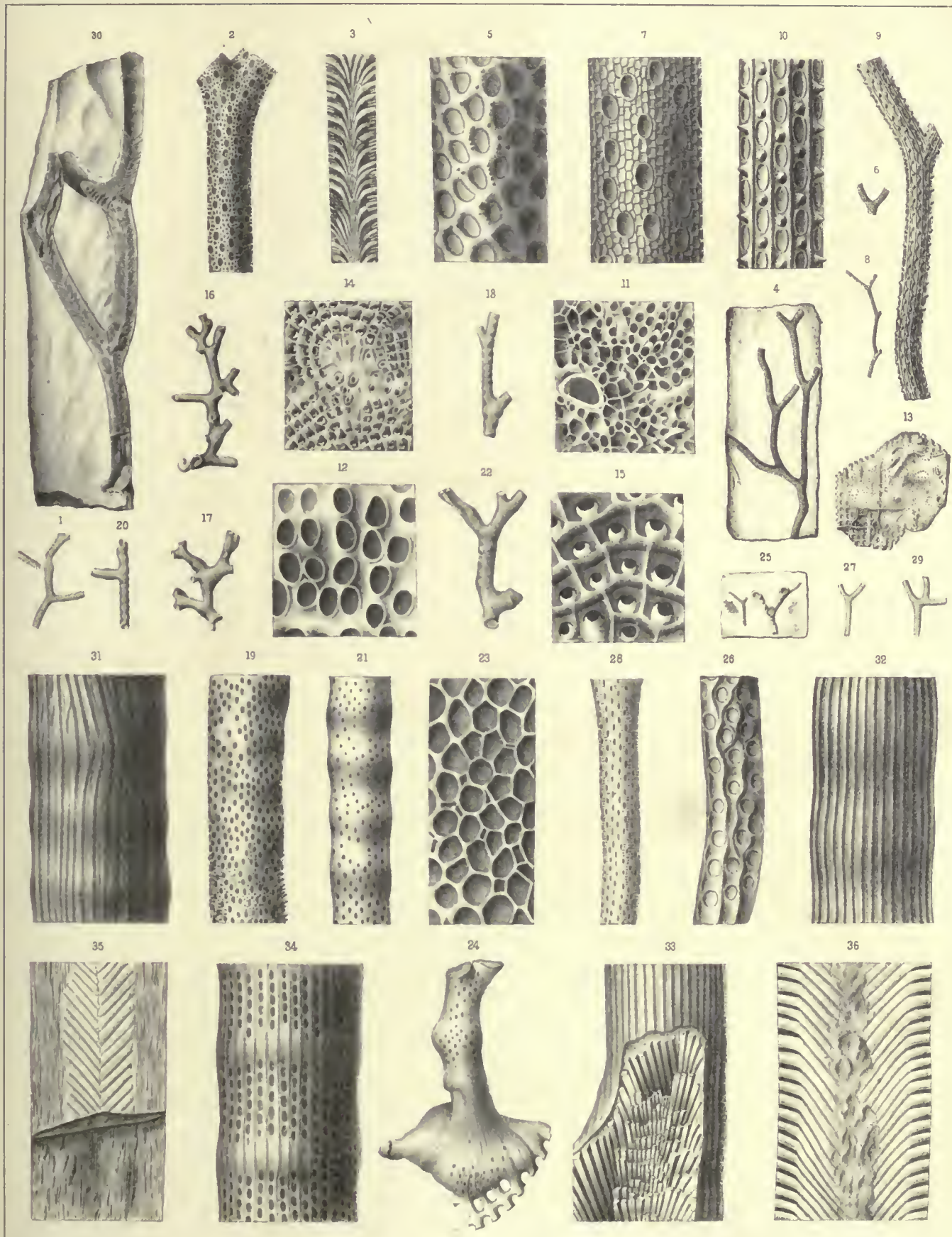
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PLATE XXVI.

Trematopora (Trematella) annulata.

Page 69.

See Plate 25.

Fig. 1. Showing the natural size and manner of growth.

Fig. 2. The same, enlarged, showing the form and arrangement of cell apertures, and the annulated appearance of the branches. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Trematopora (Orthopora) rhombifera.

Page 71.

See Plates 11, 23 and 25.

Fig. 3. A specimen, natural size, showing the manner of growth.

Fig. 4. The same, enlarged, showing the form and arrangement of cell apertures, and granulose character of intercellular space. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Trematopora (Orthopora) regularis.

Page 71.

See Plates 11, 13, 23 and 25.

Fig. 5. A specimen, natural size, showing the manner of growth.

Fig. 6. The same, enlarged, showing the form and arrangement of the cell apertures, and the pustulose intercellular spaces.

Upper Helderberg group. *Falls of the Ohio river.*

Trematopora (Orthopora) scutulata.

Page 70.

Fig. 7. A specimen, natural size, showing the manner of growth.

Fig. 8. The same, enlarged, showing the form and arrangement of cell apertures, and the spinules at the angles of the cell walls. (× 6.)

Upper Helderberg group.

Diamesopora camerata.

Page 72.

Fig. 9. A specimen, natural size.

Fig. 10. The same, enlarged, showing the form and arrangement of cell apertures, and the non-celluliferous spaces. (× 6.)

Upper Helderberg group. *Near Caledonia, N. Y.*

Callopora (Coelocaulis) irregularis.

Page 76.

Fig. 11. Natural size of a specimen, showing the manner of growth.

Fig. 12. An enlargement of fig. 11, showing the comparatively small cell apertures, which are distantly and irregularly arranged on one portion of the frond, and more closely arranged and with intermediate pits on the other. (× 6.)

Fig. 13. Another specimen, natural size, larger than that of fig. 11, and somewhat compressed.

Fig. 14. An enlargement of one portion of fig. 13, showing cells somewhat more closely arranged than in fig. 12; with no intermediate pits, and with maculæ destitute of cell apertures. (× 6.)

Fig. 15. An enlargement of another portion of fig. 13, showing the cell apertures still larger, and arranged in quite regular arching transverse rows. The peristomes composing the rows are frequently in contact. (× 6.)

Upper Helderberg group. *Central New York.*

PLATE XXVI—Continued.

Callopora (Cœlocaulis) aculeolata.

Page 76.

Fig. 16. A specimen, natural size, somewhat crushed.

Fig. 17. An enlargement of fig. 16, showing the form and arrangement of the cell apertures, the minute spines on the elevated peristomes and the intermediate pits. (× 6.)

Upper Helderberg group. *New York.*

Callopora multiseriata.

Page 75.

See Plate 25.

Fig. 18. A specimen, natural size, showing the manner of growth.

Fig. 19. An enlargement of fig. 18; showing the form and arrangement of the cell apertures and the intermediate pits, so arranged as to give a striated appearance to the surface. (× 6.)

Upper Helderberg group. *Near Le Roy, N. Y.*

Lichenalia permarginata.

Page 82.

Fig. 20. An enlargement, showing the form and arrangement of cell apertures. A single macula destitute of cells, and the larger cell apertures immediately surrounding it. (× 6.)

Upper Helderberg group. *Onondaga Valley, N. Y.*

Lichenalia (Pileotrypa) denticulata.

Page 84.

See Plate 30.

Fig. 21. A specimen, natural size, incrusting a *Fenestella.*

Fig. 22. An enlargement of a portion of the specimen, showing the form and arrangement of cell apertures and maculæ of larger cells. (× 6.)

Fig. 27. An enlargement of a portion of the surface of a specimen, showing the cells nearly parallel with the surface, and maculæ destitute of cell apertures. The apertures contiguous to the maculæ indistinctly radiate from them.

Upper Helderberg group. *Falls of the Ohio river.*

Lichenalia subcava.

Page 81.

Fig. 23. A specimen, natural size.

Fig. 24. A natural section, showing the hollow spaces beneath the elevated maculæ.

Fig. 25. An enlargement of a portion of fig. 23, showing the form and arrangement of cell apertures, and appearance of the elevated maculæ.

Upper Helderberg group. *Falls of the Ohio river.*

Lichenalia substellata.

Page 78.

See Plate 30.

Fig. 26. An enlargement of a portion of the surface, showing the form and arrangement of cell apertures. One of the sterile maculæ, in the center of the figure, shows the adjacent cell apertures larger than the others and radiating from it.

Upper Helderberg group. *Falls of the Ohio river.*

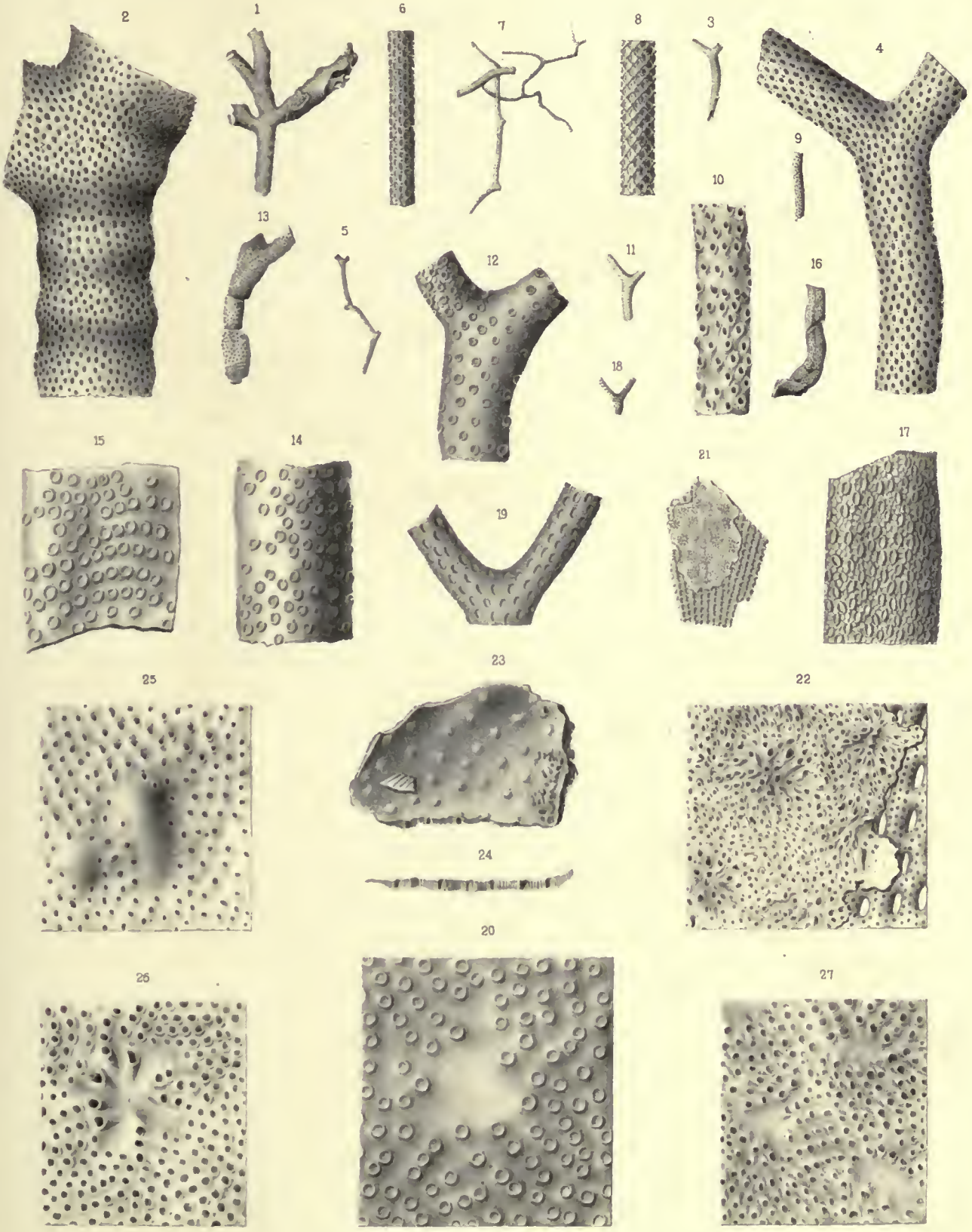
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PLATE XXVII.

STICTOPORA LINEARIS.

Page 96.

See Plate 28.

Fig. 1. A fragment enlarged to six diameters.

Upper Helderberg group. *Onondaga Valley, Onondaga Co., N. Y.*

STICTOPORA VERMICULA.

Page 93.

Fig. 2. A specimen, natural size, showing the form and manner of bifurcation.

Fig. 3. The mesotheca enlarged, showing the arching lines of growth, and the diverging and undulating, longitudinal narrow lines formed by the recumbent portions of the cell tubes. (× 6.)

Fig. 4. The surface enlarged, showing the arrangement and appearance of the cell apertures, some of which are separated by longitudinal striæ. (× 6.)

Upper Helderberg group. *Ontario, Canada.*

STICTOPORA CRESCENS.

Page 91.

Fig. 5. A fragment, natural size.

Fig. 6. A specimen enlarged. The lower portion of the figure shows the surface; the upper portion, the mesotheca with longitudinal striations and arching undulations of growth; the central portion of the figure presents the inner face of the opposite half, showing the broken ends of the cell tubes just below the apertures and the vesiculose structure between them. (× 6.)

Fig. 7. The mesotheca enlarged, showing the longitudinal striations and transverse undulations. (× 6.)

Fig. 8. A portion of the surface enlarged, showing the comparative size, form and arrangement of the cell apertures, the longitudinal elevations, and the oblique striæ on the non-celluliferous margin of the frond. (× 6.)

Fig. 9. A transverse section, showing the vertical portion of the cells. (× 6.)

Fig. 10. A transverse section of a thinner branch. (× 6.)

Fig. 11. A longitudinal section, showing the form of the cell tubes and their manner of growth. (× 6.)

Upper Helderberg group. *Ontario, Canada.*

STICTOPORA OVATIPORA.

Page 93.

See Plate 28.

Fig. 12. A specimen, natural size.

Fig. 13. A transverse section, showing the interior character of the ridges separating the longitudinal ranges of apertures. (× 6.)

Fig. 14. A transverse section, showing the vesiculose intercellular structure. (× 6.)

Fig. 15. An enlargement of a portion of the surface of a specimen, showing the pustuliform appearance of the cell apertures and the trilobate form of the openings produced by the lunate denticulations. (× 18.)

Fig. 16. A lateral view of a specimen, showing the elevation of the cellules. (× 6.)

Fig. 17. A transverse section of the same specimen, showing the sharply carinate margins. (× 6.)

Fig. 18. An enlargement of a portion of the surface of a specimen, showing the form and arrangement of the cell apertures. The denticulations are obsolete. (× 6.)

Fig. 19. An enlargement of the surface of another specimen, showing the cell apertures more distinctly denticulated.

Upper Helderberg group. *Falls of the Ohio river.*

PLATE XXVII—Continued.

STICTOPORA GILBERTI.

Page 90.

See Plate 28.

Fig. 20. A fragment of a frond, natural size.

Fig. 21. An enlargement of the adherent surface of the cells, the mesotheca having been removed. (× 6.)

Fig. 22. A transverse section, showing the form of the branch and the upright portion of the cell tubes. (× 6.)

Fig. 23. The lower portion of the figure (*a*), showing the natural surface of the frond, and on the left hand, the part adjacent (*b*), shows the cell tubes, the outer covering having been broken away; the upper right hand corner (*c*), shows the inner aspect of the opposite face. (× 6.)

Fig. 24. A longitudinal natural section enlarged, showing the form and manner of growth of the cell tubes, the strongly annulated appearance caused by the intercellular vesicular structure, and the striations on the interior of the cell-walls formed in the course of growth by the lunate denticulation of the aperture. (× 6.)

Fig. 25. A transverse section enlarged, showing the form of the branch and the interior character of the ridges separating the ranges of apertures. (× 6.)

Fig. 26. One of the cells greatly enlarged, showing more distinctly the character of the lunate denticulation. (× 40.)

Fig. 27. A transverse section enlarged to six diameters.

Fig. 28. An enlargement of the surface of a specimen, which has been much macerated, the cell apertures having the appearance of the fenestrules of some form of *Fenestella*, and the intervening space resembling the branches and dissepiments. (× 6.)

Fig. 29. The inner portion of the cœnœcium enlarged, showing the irregular vesiculose structure between the cells. (× 6.)

Fig. 30. An enlargement of a portion of the surface of a branch, showing the strong lunate denticulations, the extremities of which in the process of growth, form the parallel striations along the interior of the cell tube. (× 6.)

Fig. 31. An enlargement of a portion of the surface of a branch near the margin, where the cell apertures are pustuliform. (× 6.)

Fig. 32. An enlargement of a portion of a branch where the exterior has been removed, showing the form and arrangement of the basal portion of the cell tubes as they rise from the mesotheca.

Fig. 33. A portion of the surface of a frond enlarged, showing strong denticulations and a sharp depression along the middle of the ridge separating the ranges of cell apertures. (× 6.)

Fig. 34. An enlargement of a portion of a frond near the spreading base. (× 6.)

Fig. 35. The mesotheca enlarged, showing the radiating longitudinal lines, which mark the direction of the cell tubes, and the transverse arching undulations of growth. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

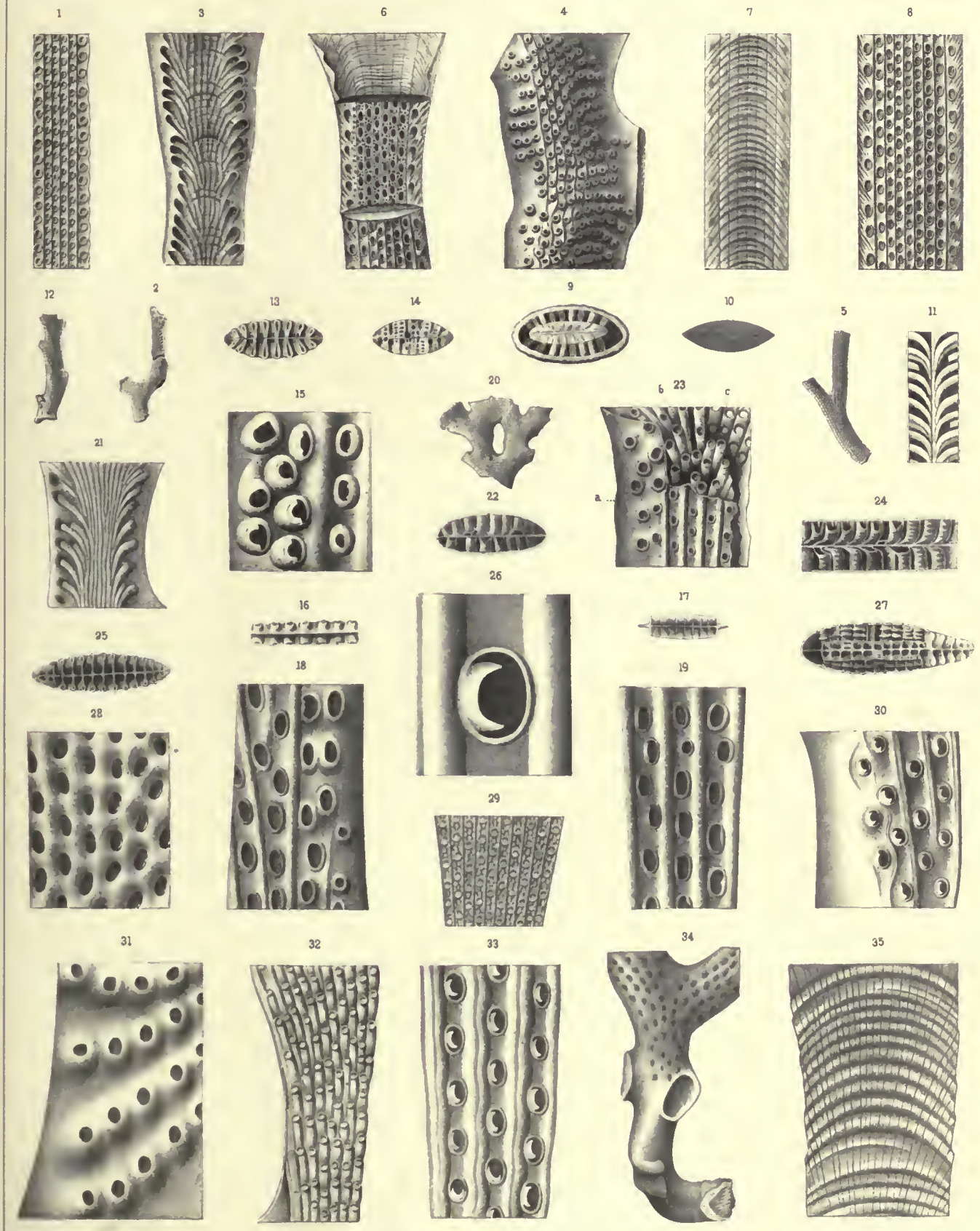
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PLATE XXVIII.

LICHENALIA, sp. ?

Fig. 1. An enlargement of a portion of the weathered face of a specimen, showing the form and arrangement of the recumbent portion of the cell tubes as they lie upon the epitheca. (× 6.)
Upper Helderberg group.

ACANTHOCLEMA DIVERGENS.

Page 73.

Fig. 2. The natural size of a specimen, showing the form and mode of branching.
Upper Helderberg group. *Onondaga Valley, N. Y.*

ACANTHOCLEMA OVATUM.

Page 73.

Fig. 3. An enlargement of a portion of a specimen, showing the form and arrangement of cell apertures, with ridges separating the longitudinal ranges of apertures. (× 6.)
Upper Helderberg group. *Onondaga Valley, N. Y.*

STICTOPORA LINEARIS.

Page 96.
See Plate 27.

Fig. 4. An enlargement of a portion of a specimen, showing the form and arrangement of cell apertures, and the longitudinal ridges separating the ranges of apertures. (× 6.)

Fig. 5. An enlargement of a portion of a weathered specimen. The surface between the cell walls is worn away, giving to the surface the appearance of having contiguous, quadrangular cell apertures.
Upper Helderberg group. *New York.*

ACANTHOCLEMA TRISERIALE.

Page 74.

Fig. 6. A specimen, natural size.

Fig. 7. A portion of the preceding enlarged, showing the form and arrangement of the cell apertures, and the strong granulose ridges separating the longitudinal ranges. (× 6.)
Upper Helderberg group. *Near Caledonia, N. Y.*

PRISMOPORA TRIQUETRA.

Page 97.
See Plate 29.

Fig. 8. A specimen, natural size.

Fig. 9. An enlargement of a portion of a specimen, giving an oblique view of two of the three faces. (× 6.)

Fig. 10. An enlargement from the same specimen, showing the concave face, and the form and arrangement of the cell apertures.
Upper Helderberg group. *Falls of the Ohio river.*

PRISMOPORA PAUCIRAMA.

Page 98.
See Plate 29.

Fig. 11. An enlargement of a transverse section, showing the internal plates radiating from the center to each of the angles, a few of the cell tubes, and the intercellular vesiculose structure. (× 6.)
Upper Helderberg group. *Thompson's lake, Albany Co., N. Y.*

PLATE XXVIII—Continued.

STICTOPORA FRUTICOSA.

Page 92.

Fig. 12. A specimen, natural size, showing the mode of branching and arrangement of cell apertures.

Fig. 13. An enlargement from a portion of fig. 12, the surface being well preserved, showing the form and arrangement of cell apertures, and the ornamentation of the intercellular space and of the non-celluliferous margin.

Fig. 14. An enlargement from a portion of fig. 12, the surface being much weathered. The cell apertures are larger than those of fig. 13, and apparently more irregularly arranged. The ornamentation of the surface is nearly or quite obsolete.

Upper Helderberg group. *New York.*

STICTOPORA RIGIDA.

Page 91.

Fig. 15. A specimen, natural size, showing the rigid form and mode of branching.

Fig. 16. A portion of fig. 15, enlarged, showing the form and arrangement of cell apertures, the striated longitudinal ridges and the non-celluliferous margin. (× 6.)

Upper Helderberg group. *Near Le Roy, N. Y.*

STICTOPORA SEMISTRIATA.

Page 95.

Fig. 17. A specimen, natural size, regularly bifurcating.

Fig. 18. A specimen, natural size having lateral branches.

Fig. 19. A portion of a specimen enlarged, showing the form and arrangement of cell apertures, and strong longitudinal ridges. (× 6.)

Fig. 20. An enlargement of a portion of another specimen, on which the cell apertures are apparently more irregularly arranged, and the longitudinal striations are obsolete.

Upper Helderberg group. *Near Le Roy, N. Y.*

STICTOPORA GILBERTI.

Page 90.

See Plate 27.

Fig. 21. A specimen, natural size, showing the form and mode of branching.

Fig. 22. An enlargement of a portion of fig. 21, showing more plainly the mode of bifurcation, the non-celluliferous margins, the form and arrangement of cell apertures, and the longitudinal striations or ridges. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

STICTOPORA OVATIPORA.

Page 93.

See Plate 27.

Fig. 23. A specimen, natural size, showing the form and mode of growth near the base.

Fig. 23*a*. An enlargement of fig. 23, showing the base, mode of branching, non-celluliferous margin, form and arrangement of cell apertures, and the strong longitudinal ridges. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

STICTOPORA INVERTIS.

Page 94.

Fig. 24. A specimen, natural size, showing the form and mode of branching.

Fig. 25. An enlargement of a portion of fig. 24, showing the non-celluliferous margin, and the form and arrangement of the cell apertures.

Fig. 26. A vertical section from fig. 24, showing the mesial septum and the form and manner of growth of the cell tubes.

Upper Helderberg group. *New York.*

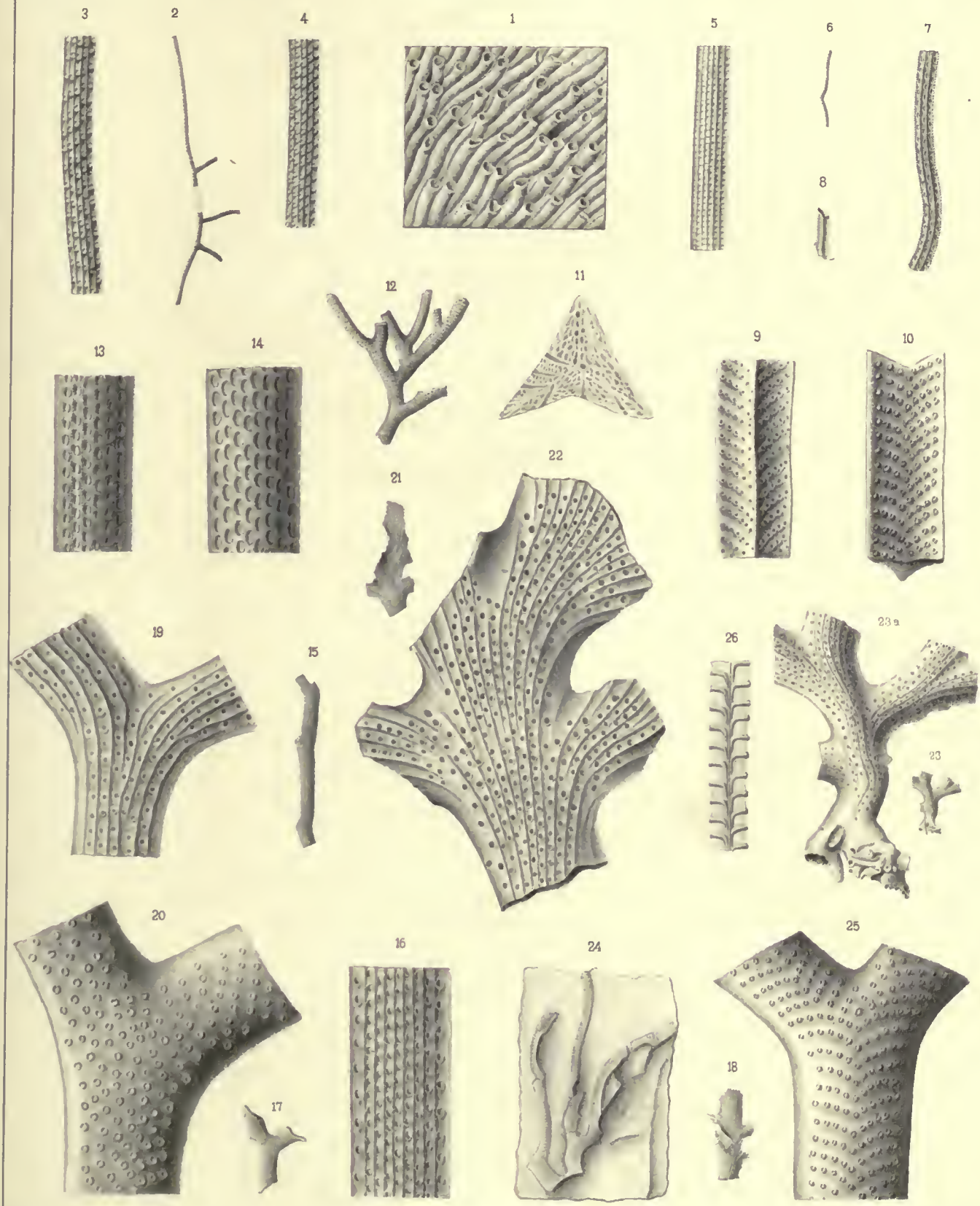
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PLATE XXIX.

SCALARIPORA SUBCONCAVA.

Page 100.

Fig. 1. A fragment, natural size.

Fig. 2. A transverse section of a branch, showing its form, the celluliferous scalæ, the internal radiating mesotheca, and the intercellular vesicular structure. (× 6.)

Fig. 3. An enlargement of one of the faces, showing the scalæ and the form and arrangement of the cell apertures. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

SCALARIPORA SCALARIFORMIS.

Page 100.

Fig. 4. A fragment, natural size.

Fig. 5. An enlargement of one of the faces of a fragment, showing the scale and the form and arrangement of the cell apertures. (× 6.)

Fig. 6. A view, looking directly upon one of the angles, showing the angular margins, the scalæ of two of the faces and the form and arrangement of the cell apertures. (× 6.)

Fig. 7. An oblique view of one of the faces, showing the concavity of the surface, the arrangement of the external celluliferous scalæ, and the form and disposition of the cell apertures (× 6.)

Fig. 8. A transverse section of a branch, showing the form of the celluliferous scalæ, the radiating mesotheca and the divergent cell tubes. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

PRISMOPORA TRIQUETRA.

Page 97.

See Plate 28.

Figs. 9, 10, 11. Fragments, natural size, showing the ordinary variations in form and appearance.

Fig. 12. A portion of one of the faces of a frond enlarged, showing the non-celluliferous margins, and the form and arrangement of the cell apertures. (× 6.)

Fig 13. An enlargement, of the surface from near the margin of one of the faces, showing the very oblique cell apertures, with prominent denticulate margins; the denticulations giving to the apertures a subtrilobate form. (× 18.)

Fig. 14. An enlargement from another specimen, showing the ranges of apertures separated by prominent ridges; the denticulations of the cell margins are much more conspicuous than in figure 13. (× 6.)

Fig. 15. A transverse section of a branch, showing the concave faces, the radiating plates or mesothecæ and the upright portion of the cells.

Upper Helderberg group. *Falls of the Ohio river.*

PRISMOPORA PULCHRAMA.

Page 98.

See Plate 28.

Fig. 16. A fragment, natural size.

Fig. 17. An enlargement of one of the faces, showing the form and arrangement of the cell apertures. (× 6.)

Upper Helderberg group. *Onondaga Valley, Onondaga County, N. Y.*

PLATE XXIX—Continued.

INTRAPORA PUTEOLATA.

Page 97.

Figs. 18-22. Fragments, natural size, showing the ordinary variations in form of different fronds

Fig. 23. An enlargement of a portion of the surface of a frond, showing circular cell apertures; the interapertural pits on a portion of the figure are obsolete. (× 18.)

Fig. 24. An enlargement of a part of a frond, showing the form and mode of bifurcation, the arrangement of the cell apertures, the interapertural pits, and the non-celluliferous space at the margin having indistinct pits arranged in oblique rows, resembling oblique striations.

Fig. 25. A transverse section of one-half of a frond, enlarged, showing the mesotheca and the upright portion of the cell tubes. (× 6.)

Fig. 26. An enlargement, to eighteen diameters, of a portion of the specimen, fig. 24, from near the margin, showing more distinctly the character of the cell apertures and intermediate pits and the non-celluliferous striated margin.

Upper Helderberg group. *Falls of the Ohio river.*

STICTOPORA RHOMBOIDEA.

Page 95.

Fig. 27. A fragment, natural size.

Fig. 28. The surface, enlarged, showing the form and arrangement of the cell apertures. (× 6)

Upper Helderberg group. *Near Le Roy, N. Y.*

COSCINOTRYPA CRIBRIFORMIS, var. CARINATA.

Page 89.

See Plate 33.

Fig. 29. A fragment, natural size.

Fig. 30. A transverse section, natural size.

Figs. 31-33. Fragments, natural size, showing the common variations of the different fronds in the size of the fenestrules and general appearance of the surface.

Fig. 34. A portion of the surface of a frond, enlarged, showing alternating and imbricating cell apertures. (× 18.)

Fig. 35. An enlargement, showing one of the fenestrules, and the ordinary form and arrangement of the denticulated cell apertures. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

STICTOPORA PERARCTA, *Hall.*

Page 96.

Fig. 36. A fragment, natural size.

Fig. 37. The surface enlarged, showing the form and arrangement of the cell apertures. (× 18.)

Upper Helderberg group. *Onondaga Valley, N. Y.*

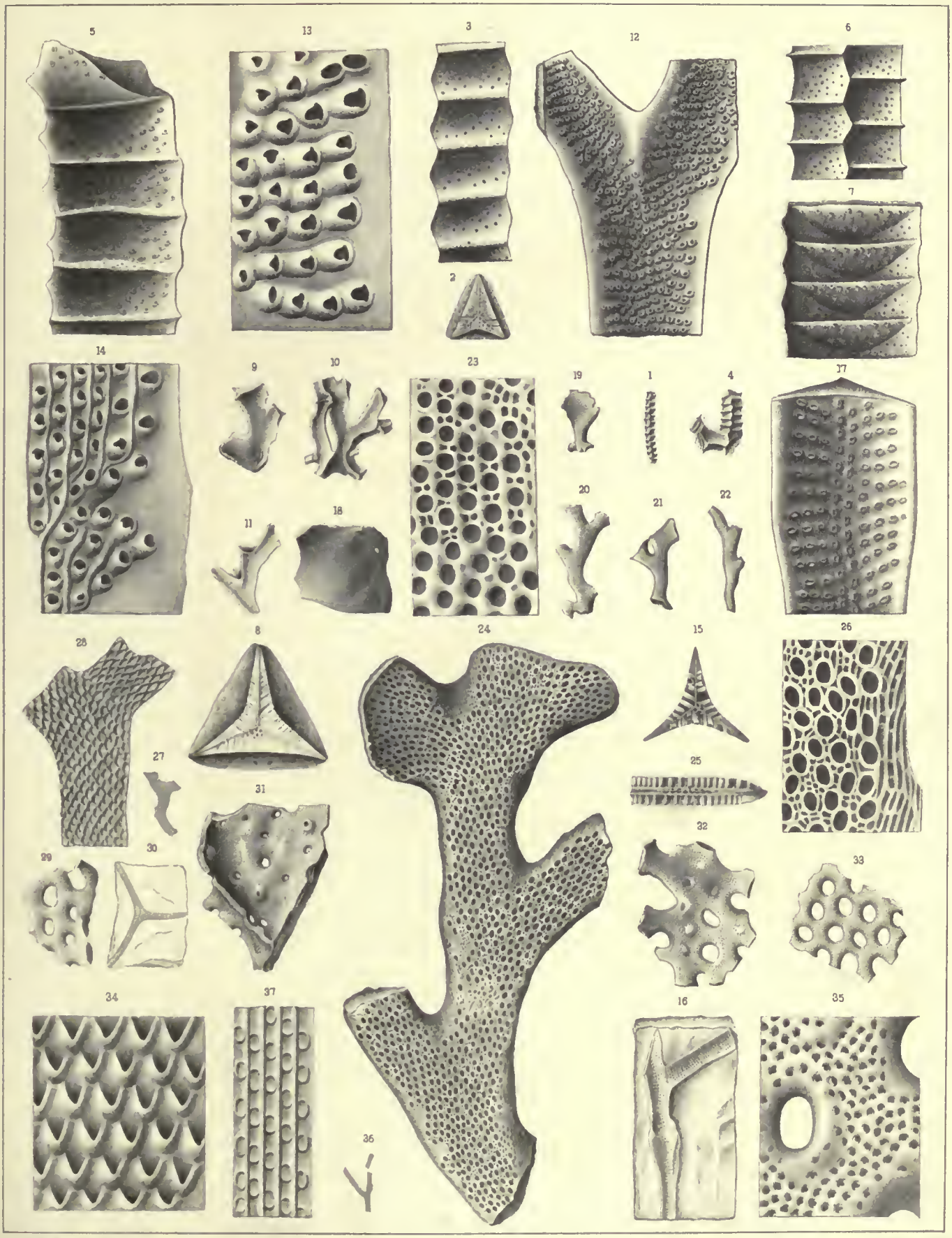
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PLATE XXX.

LICHENALIA SUBSTELLATA.

Page 78.

See Plate 26.

Fig. 1. A specimen, natural size, having elevated maculæ.

Fig. 2. A specimen, showing the general aspect of the species, the form and arrangement of the maculæ, and the large cellules immediately surrounding them.

Fig. 3. One of the maculæ, showing the contiguous cell apertures. (× 16.)

Fig. 4. A portion of the surface, showing the cell apertures closed by opercula. (× 16.)

Fig. 5. Another portion, showing the cell apertures. (× 16.)

Fig. 6. An enlargement of the oblique cell apertures, with a portion of the cell tubes exposed. (× 16.)

Fig. 7. A portion of a frond, where the surface has been worn away, showing the interstitial pits. (× 16.)

Fig. 8. A portion of the surface, showing cell apertures with elevated margins and obscure denticulations. (× 16.)

Fig. 9. A vertical section, showing cell tubes and septate intercellular tubules.

Fig. 10. A vertical section from another frond, showing the cell tubes more closely arranged than in the preceding.

Fig. 11. A portion of the surface, showing some of the cell apertures, closed and presenting a pustuliform aspect. (× 16.)

Upper Helderberg group. *Falls of the Ohio river.*

LICHENALIA (PILEOTRYPA) DENTICULATA.

Page 84.

See Plate 26.

Fig. 12. A specimen, natural size, showing the general appearance of the species, the form and arrangement of the maculæ etc.

Fig. 13. A portion of the surface of the preceding, showing the form and arrangement of the cell apertures. (× 6.)

Fig. 14. An oblique view of a portion of the surface, showing the height and form of the elevated cell margins. (× 6.)

Fig. 15. Two views, each one of a single cell aperture seen obliquely from above, and greatly enlarged, showing more distinctly the appearance of the elevated cell margins. The figure has been inadvertently shaded between the cells which should be represented as two distinct figures.

Fig. 16. Front and lateral views of the elevated cell margins. (× 16.)

Fig. 17. A portion of the surface of a frond, showing the form and arrangement of the cells and the denticulated cell margins. (× 16.)

Fig. 18. Three cell apertures much enlarged, to show the variation in their form and margins.

Fig. 19. A vertical section of a portion of a frond, showing oblique cell tubes.

Fig. 20. A vertical section from another frond, showing the cell tubes and intercellular vesicular structure.

Upper Helderberg group. *Falls of the Ohio river.*

PLATE XXX—Continued.

Fistulipora lamellata.

Page 87.

Fig. 21. A portion of the surface, showing the form and arrangement of the cell apertures and intercellular pits. (× 6.)

Fig. 22. A portion of the same. (× 18.)

Fig. 23. The surface of another specimen, in which the intercellular pits are obsolete. (× 16.)

Upper Helderberg group. *Onondaga Valley, N. Y.*

Lichenalia (Odontotrypa) alveata.

Page 85.

Fig. 24. A specimen, natural size, incrusting a *Fenestella*.

Fig. 25. A portion of the surface of the preceding, showing the form and arrangement of the cell apertures. (× 6.)

Fig. 26. A front view of the cell apertures, showing their form and the elevation of the margins. (× 6.)

Fig. 27. A portion of their surface. (× 16.)

Upper Helderberg group. *Falls of the Ohio river.*

Lichenalia (Pileotrypa) granifera.

Page 84.

Fig. 28. A specimen, natural size.

Fig. 29. A portion of the surface from the preceding, showing the form and arrangement of the cell apertures and the interapertural granules. (× 6.)

Fig. 30. A few of the cell apertures, showing more distinctly the elevated margins and the granulated interapertural space. (× 18.)

Fig. 31. A vertical section of a portion of a frond, showing the constricted and septate cell tubes and intermediate septate tubuli.

Upper Helderberg group. *Falls of the Ohio river.*

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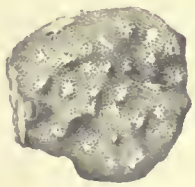
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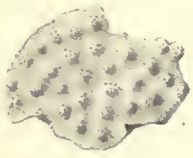
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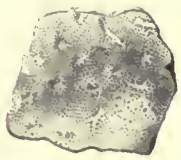
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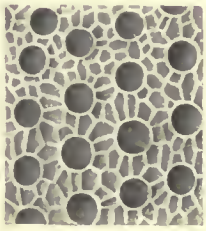
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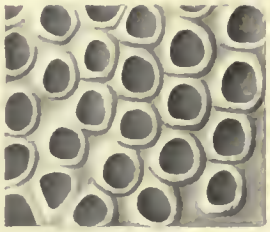
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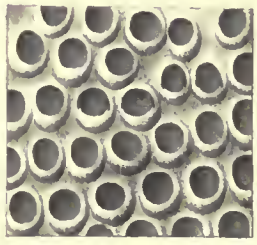
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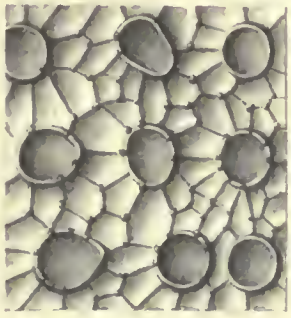
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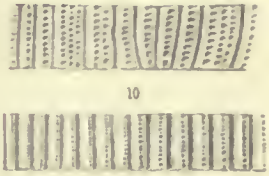
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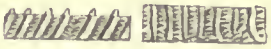
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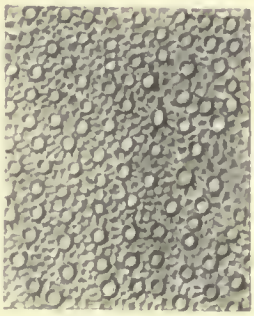
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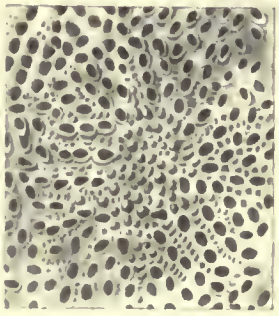
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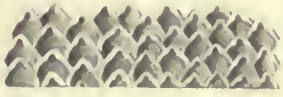
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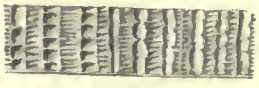
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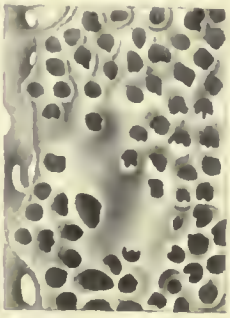
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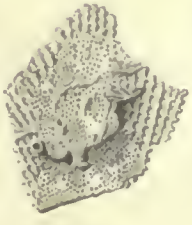
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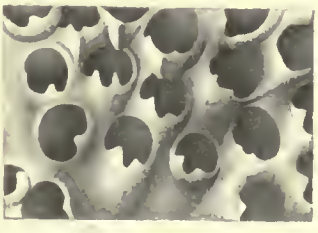
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PLATE XXXI.

LICHENALIA LUNATA.

Page 77.

Fig. 1. The upper surface of a specimen, natural size.
Fig. 2. An enlargement of the surface to show the arrangement of the cell apertures. (× 6.)
Fig. 3. A specimen in which the surface has been removed, showing the intercellular structure. (× 6.)
Fig. 4. A vertical section, showing the septate cell tubes, the striations left by the denticulations of the aperture in its advancing growth, and the intermediate septate tubuli. (× 6.)
Fig. 5. A vertical section, showing the irregular vesicular structure of the intercellular tissue. (× 6.)
Fig. 6. A vertical section, showing the striation of the cell walls and a solid intercellular space. (× 6.)
Fig. 7. A portion of the surface, enlarged, showing the cell apertures and denticulations. (× 18.)
Fig. 8. A single cell aperture, enlarged to 40 diameters.
Fig. 9. A portion of an abraded surface, showing the character of the intercellular tissue.

Upper Helderberg group. *Falls of the Ohio river.*

LICHENALIA CONULATA.

Page 81.

Fig. 10 A fragment of a specimen, natural size.
Fig. 11. A portion of the surface enlarged, showing an inflated pustuliform condition. (× 10.)
Fig. 12. An enlargement of the surface from the center of a monticule, showing the cell apertures projected on the exterior in the form of inflated oviform expansions with contracted apertures. (× 18.)
Fig. 13. An enlargement of an abraded surface, showing the intercellular tissue. (× 18.)
Fig. 14. A vertical section, showing an irregular vesiculose structure near the base, becoming more regular above.

Upper Helderberg group. *Falls of the Ohio river.*

LICHENALIA? (GLOSSOTRYPA) PALIFORMIS.

Page 85

Fig. 15. A fragment of a tubular branch or frond, natural size.
Fig. 16. An enlargement of the preceding, showing the arrangement of the cell apertures. (× 6.)
Fig. 17. An enlargement of a portion of the surface. (× 18.)
Fig. 18. A section of the tubular frond, showing the cells with indications of intercellular tissue. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

LICHENALIA (SELENOPORA) COMPLEXA.

Page 87.

Fig. 19. A portion of the natural surface enlarged, showing the character of the cell apertures with their vestibular areas. (× 6.)
Fig. 20. The surface of another specimen, showing larger apertures and surrounding areas than the preceding. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

LICHENALIA (PILEOTRYPA) PYRIFORMIS.

Page 82.

Fig. 21. A fragment, natural size.
Fig. 22. A portion of the surface where the cell openings have strongly elevated and denticulated posterior margins. (× 18.) The anterior margins of the apertures, as represented in the figure, are too prominent.
Fig. 23. A vertical section, showing the intermediate vesicular structure which has marked the exterior of the cell walls. (× 6.)

PLATE XXXI—Continued.

Fig. 24. An oblique view of the surface, showing the projecting posterior margins of the cell apertures. (× 6.)

Fig. 25. A vertical section of a thin lamina incrusting a FENESTELLA, and showing prominent posterior cell margins. (× 6.)

Fig. 26. A portion of the surface of a specimen enlarged, showing the denticulate peristomes at right angles to the general surface, with the intermediate space bullate. (× 18.)

Fig. 27. An enlargement of the surface of a specimen where the cell apertures, on the lower part of the figure, are very oblique, while in the upper portion they are nearly rectangular to the surface, with a bullate intermediate space. This latter feature is obscurely shown on some parts of the surface where the cells are oblique.

Upper Helderberg group. *Falls of the Ohio river.*

LICHENALIA LUNATA, var. TUBULATA.

Page 78.

Fig. 28. A fragment of a tubular specimen, natural size.

Fig. 29. An enlargement of a portion of the preceding, showing the form and arrangement of the denticulate apertures. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

LICHENALIA (PILEOTRYPA) CLIVULATA.

Page 83.

Fig. 30. A fragment of a tubular ramose form, natural size.

Fig. 31. A portion of the surface enlarged, showing one of the monticules and adjacent cell apertures.

Fig. 32. A portion of the surface further enlarged, showing an irregular disposition of the cell apertures, marked by the prominent peristomes which are excessively developed on the posterior side, and the intermediate nodulose surface. (× 18.)

Fig. 33. A vertical section, showing the open cells and the regularly septate intercellular space. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

PHRACTOPORA CRISTATA var. LINEATA.

Page 99.

Fig. 34. A fragment, natural size.

Fig. 35. An enlargement of the surface of the preceding, showing the character of the cell apertures and the narrow slightly elevated crests traversing the surface. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

PHRACTOPORA CRISTATA.

Page 99.

Fig. 36. A portion of a frond, natural size.

Fig. 37. An enlargement from the surface of the preceding, showing the character of the cell apertures. (× 6.)

Fig. 38. A section through the carinæ, showing the radiating mesotheca, the cells and intercellular structure. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

LICHENALIA ALTERNATA.

Page 80.

Fig. 39. A fragment, natural size.

Fig. 40. A portion of the surface enlarged, to show the character and arrangement of cell apertures. (× 6.)

Fig. 41. A portion of the surface still further enlarged and presenting a somewhat different aspect of the cell apertures.

Upper Helderberg group. *Falls of the Ohio river.*

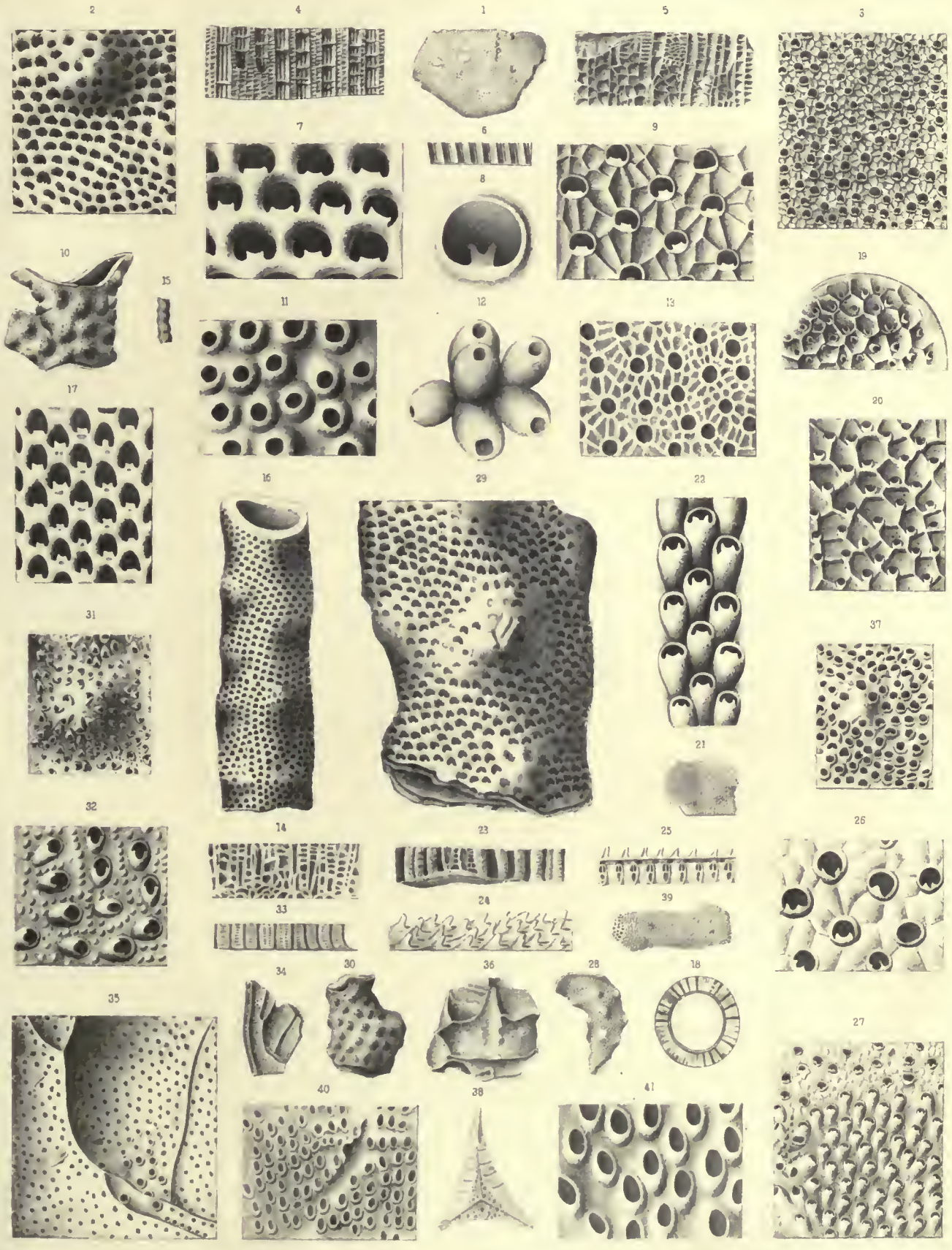
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PLATE XXXII.

Lichenalia ovata.

Page 80.

Fig. 1. A fragment of a frond, natural size.

Fig. 2. An enlargement of a portion of the surface, to show the form and arrangement of the cell apertures. (× 6.)

Fig. 3. A portion of the surface still further enlarged, showing broadly ovate cell apertures with the denticulations more or less distinct. (× 18.)

Fig. 4. An enlargement, showing the apertures more nearly circular and usually destitute of denticulations. (× 18.)

Fig. 5. A section, showing the vertical non-septate cells with the intercellular space regularly septate. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Lichenalia bistriata.

Page 79.

Fig. 6. A fragment of a frond, natural size.

Fig. 7. A portion of a surface of fig. 6 enlarged, showing one of the maculæ and adjacent cells. (× 6.)

Fig. 8. An enlargement from a surface which has been weathered, partially obliterating the peristomes. (× 18.)

Fig. 9. An enlargement, showing the character of the cell apertures when well-preserved. (× 18.)

Fig. 10. A vertical section, showing the cells without septa, the intermediate space being vesiculose or regularly septate. (× 6.)

Fig. 11. A fragment of another specimen, natural size.

Fig. 12. An enlargement of the surface which has been somewhat weathered, showing the lunate form of the apertures. (× 6.)

Fig. 13. A portion of the surface enlarged, showing the character of the cell apertures when in a perfect condition. (× 18.)

Fig. 14. A vertical section, showing the cells without septa, with the intermediate space regularly septate. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fistulipora intercellata.

Page 87.

Fig. 15. A fragment of a specimen, natural size, incrusting a Fenestella.

Fig. 16. A portion of the same enlarged, showing the form and arrangement of the cell apertures and intermediate pits or mesopores. The surface is partially covered by other organisms. (× 6.)

Fig. 17. A fragment of another specimen, natural size.

Fig. 18. An enlargement of the preceding, showing the cell apertures larger and more closely arranged than in fig. 16. (× 6.)

Fig. 19. A portion of the specimen fig. 17, still further enlarged, showing the character of the cell apertures and the mesopores. (× 18.)

Fig. 20. A vertical section, showing the non-septate cells and the septate interspaces.

Upper Helderberg group. *Falls of the Ohio river.*

PLATE XXXII—Continued.

LICHENALIA GEOMETRICA.

Page 79.

Fig. 21. A fragment, natural size.

Fig. 22. An enlargement of one of the macula, showing the smooth or carinated radiating cell tubes, with oval apertures, and the character of the intermediate space. (× 18.)

Fig. 23. A portion of the surface of the specimen fig. 21, incrusting a FENESTELLA. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

PRISMOPORA SPARSIPORA.

(See Supplement.)

Fig. 24. A fragment, natural size.

Fig. 25. An enlargement of the surface from the preceding, showing the arrangement of the cell apertures, and the non-celluliferous margin of the frond. (× 6.)

Fig. 26. A portion of the surface still further enlarged. The figure, erroneously, shows two minute opposite denticulations in each cell aperture. (× 6.)

Fig. 27. A transverse section of a specimen, apparently of the same species, which shows a tubular mode of growth.

Upper Helderberg group.

LICHENALIA sp. indet.

Fig. 28. A portion of the surface of a species of this genus, showing the contraction, and final closing of the cell apertures by a thickening of the superficial tissue.

Upper Helderberg group.

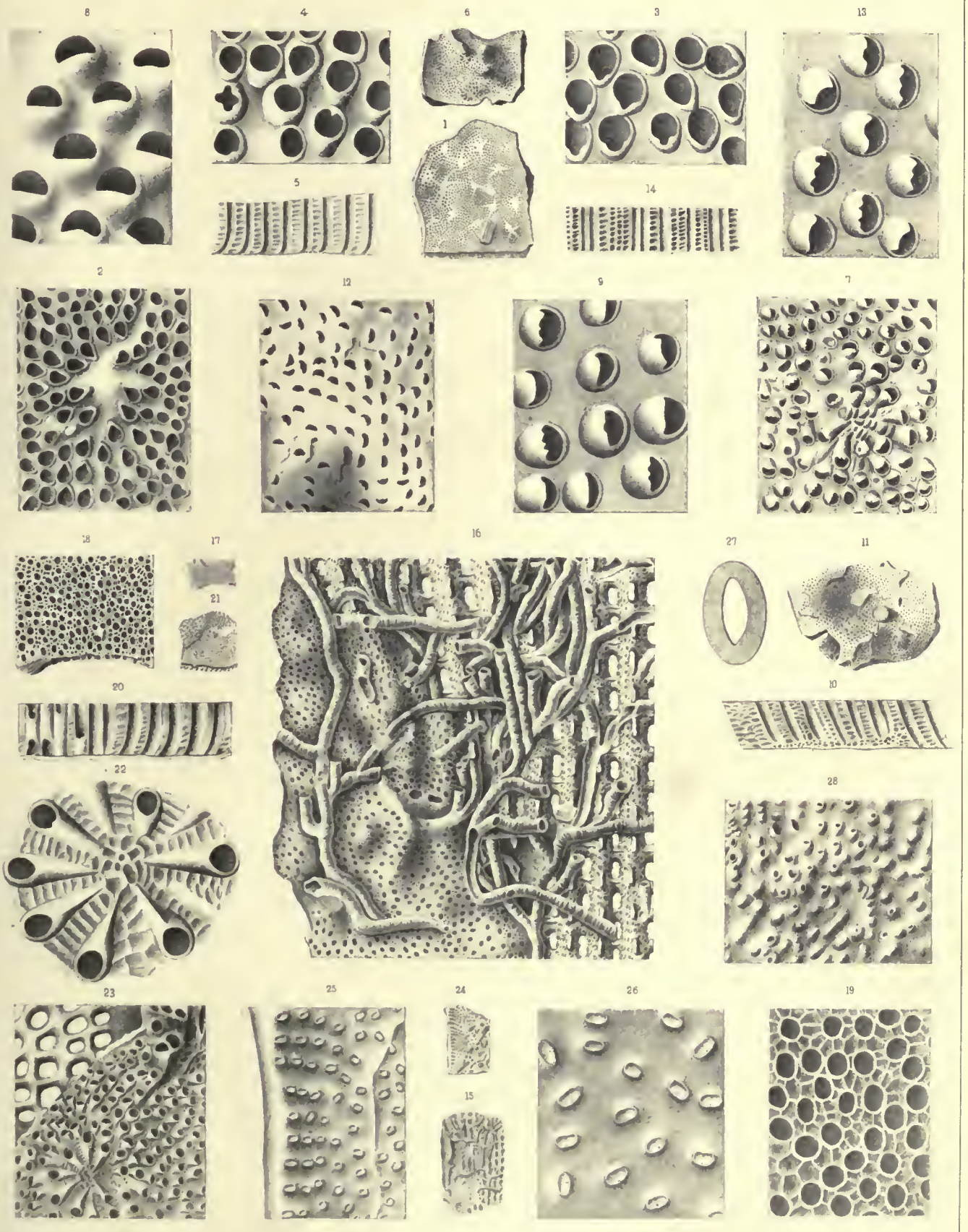
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PLATE XXXIII.

Thamniscus multiramus.

Page 104.

Figs. 1–3. Specimens, natural size; showing the form and mode of branching.

Fig. 4. An enlargement of a portion of fig. 3. The surface is weathered or macerated, so that the recumbent portions of the cell-tubes are shown; a small part of the surface is preserved, showing the form and arrangement of the cell apertures.

Fig. 5. An enlargement of the non-celluliferous side of a specimen, showing sharp striations. (× 6.)

Upper Helderberg group. *Schoharie, N. Y.*

Crisinella scrobiculata.

Page 103.

Fig. 6. A specimen, natural size, showing the form and mode of branching.

Flg. 7. An enlargement of a portion of the non-celluliferous side of fig. 6, showing fine striations, and cell-tubes projecting beyond the margin.

Fig. 8. An enlargement of a portion of the celluliferous side of fig. 6, showing the form and arrangement of cell apartures, and the shallow intercellular pits on a portion of the surface.

Upper Helderberg group. *Western New York.*

Thamnotrypa divaricata.

Page 101.

Fig. 9. A specimen, natural size, showing the form and mode of branching.

Fig. 10. An enlargement of a portion of one side of fig. 9, showing the non-celluliferous margins the central ridge, and the form and arrangement of cell apertures.

Upper Helderberg group. *Near Buffalo, N. Y.*

Glauconome sinuosa.

Page 101.

Fig. 11. A specimen, natural size, showing the form and mode of growth.

Fig. 12. An enlargement of a portion of the celluliferous side of fig. 11, showing more distinctly the mode of growth, the sinuous carinæ, and the form and arrangement of the cell apertures.

Upper Helderberg group. *Near Buffalo, N. Y.*

Glauconome nodata.

Page 102.

Fig. 13. A specimen, natural size, showing the form and mode of branching,

Fig. 14. An enlargement of a portion of the celluliferous side of fig 13, showing more distinctly the mode of growth, the form and arrangement of cell apertures.

Upper Helderberg group. *Near Le Roy, N. Y.*

PLATE XXXIII—Continued.

GLAUCONOME TENUISTRIATA.

Page 102.

Fig. 15. A specimen, natural size, showing the form and mode of branching.

Fig. 16. An enlargement of the non-celluliferous side of fig. 15, showing more distinctly the mode of branching, and the fine striations.

Fig. 17. An enlargement of a portion of the celluliferous side of another specimen, showing the narrow carina, and the form and arrangement of the cell apertures. (× 6.)

Fig. 18. An enlargement of the non-celluliferous side of a specimen; a portion of the surface has been worn away, showing the polygonal cells.

Fig. 19. An enlargement of the celluliferous side of a specimen. The specimen is macerated, the surface having been worn away, showing the striated character of the solid portion of the branch.

Upper Helderberg group. *Near Buffalo, N. Y.*

COSCINIUM STRIATURUM.

Page 88.

Fig. 20. A specimen, natural size, showing the size and position of the perforations, and indistinctly the cell tubes.

Fig. 21. An enlargement of a portion of fig. 20, showing one of the perforations; the form and arrangement of the cell apertures, with coarsely striated texture beneath the exterior surface.

Upper Helderberg group. *Stafford, N. Y.*

COSCINOTRYPA CRIBRIFORMIS, var. CARINATA.

Page 89.

See Plate 29.

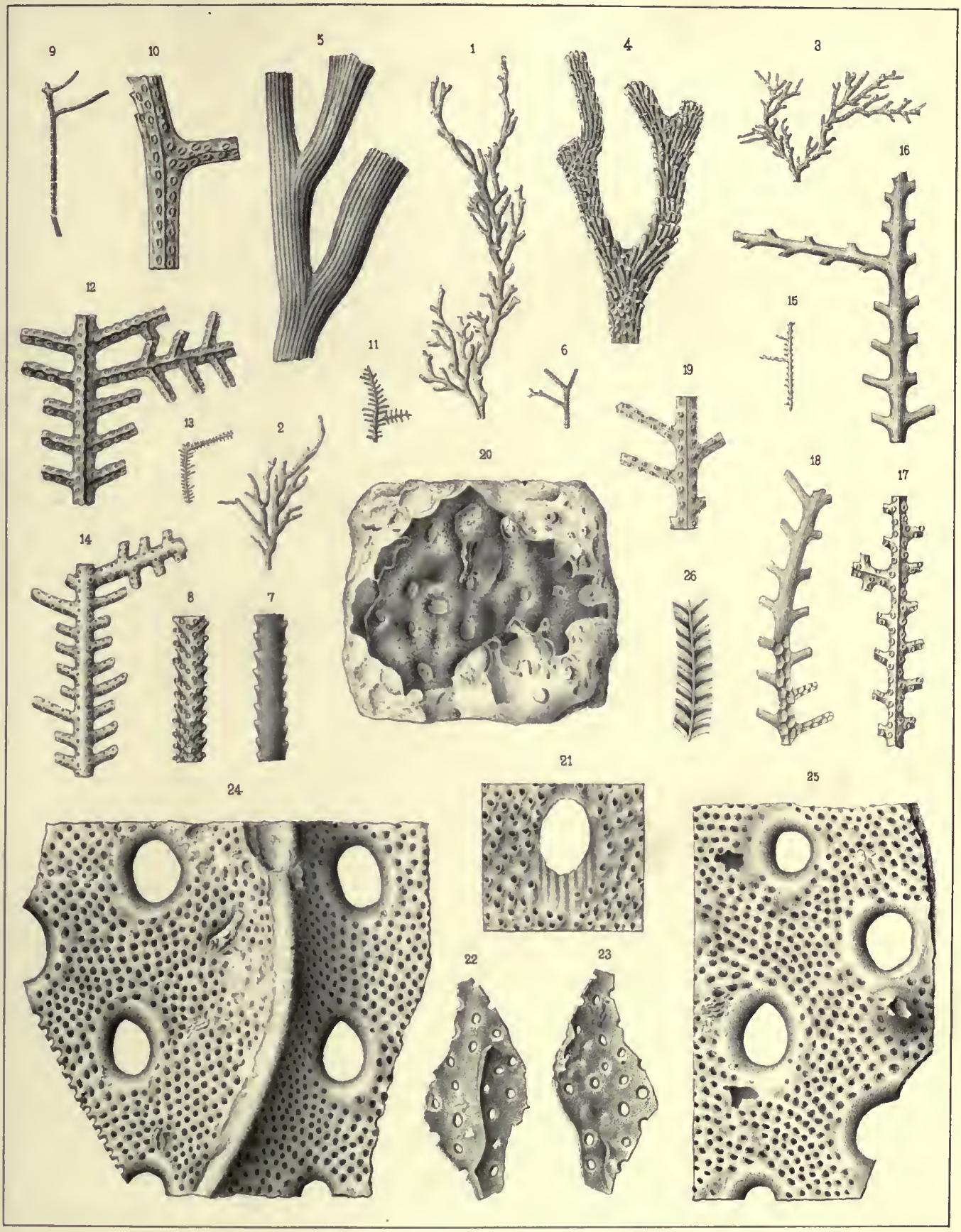
Fig. 22. A specimen, natural size, showing a strongly elevated carina, and the form and arrangement of the perforations.

Fig. 23. The reverse side of the preceding specimen.

Fig. 24. An enlargement of a portion of fig. 22, showing the carination, the aspect of the perforations, and the form and arrangement of the cell apertures; the surface is somewhat macerated, and the cell apertures are not in a perfect condition.

Fig. 25. An enlargement of a portion of fig. 23.

Upper Helderberg group. *Falls of the Ohio river.*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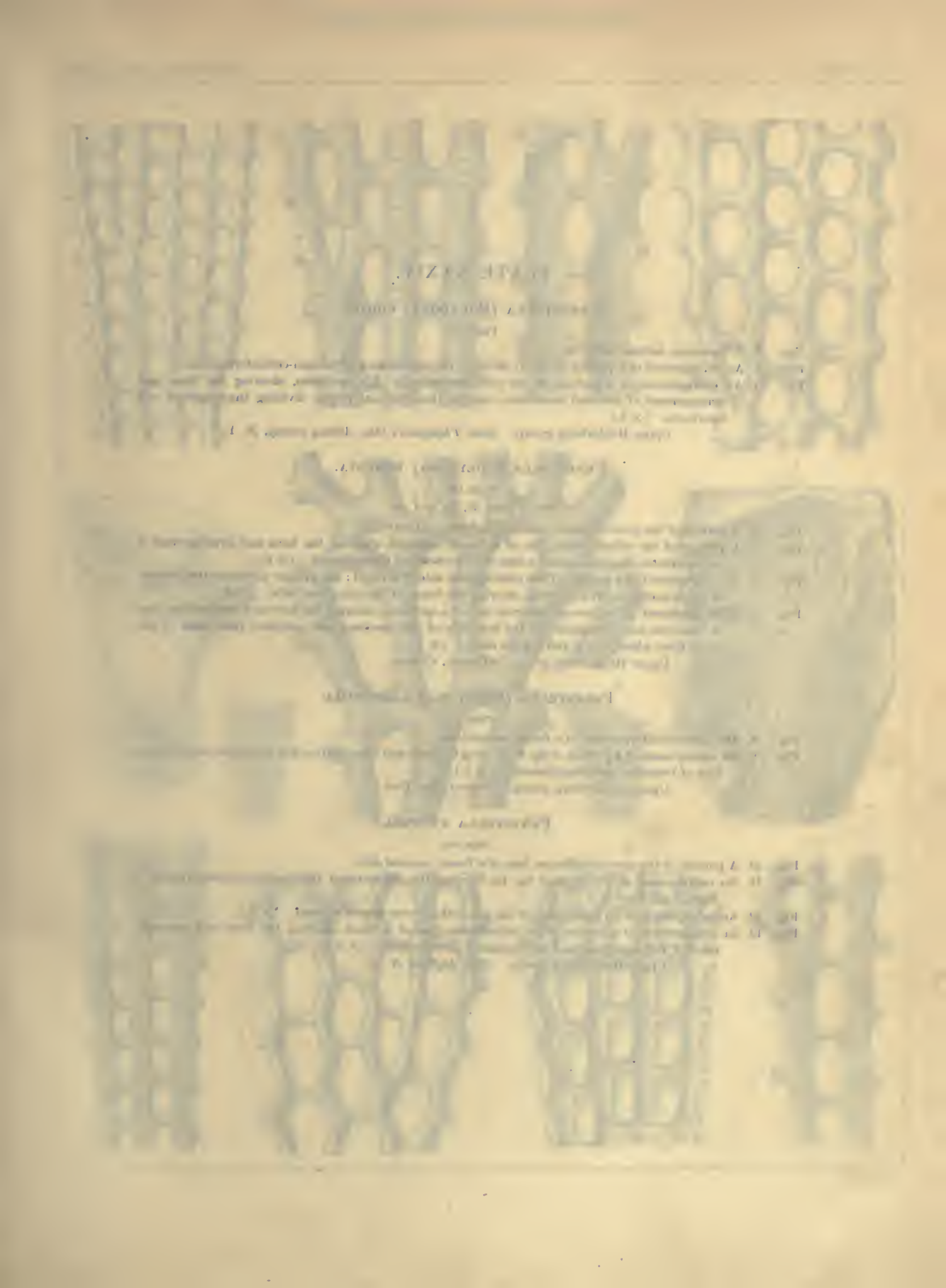


PLATE XXXIV.

Fenestella (Polypora) rigida.

Page 155.

Fig. 1. A specimen, natural size.

Fig. 2. An enlargement of a portion of fig. 1, showing the appearance of the non-celluliferous side.

Fig. 3. An enlargement of a portion of the celluliferous side of a specimen, showing the form and arrangement of the cell apertures, and the longitudinal ridges dividing the ranges of cell apertures. (× 6.)

Upper Helderberg group. *Near Thompson's lake, Albany county, N. Y.*

Fenestella (Polypora) robusta.

Page 156.

See Plates 37, 39 and 46.

Fig. 4. A portion of the non-celluliferous side of a frond, natural size.

Fig. 5. A portion of the celluliferous side of a frond, enlarged, showing the form and arrangement of cell apertures, and comparative size of branches and dissepiments. (× 6.)

Fig. 6. An enlargement of a portion of the celluliferous side of a frond; the greater portion of the exterior of the branches is broken away, showing the bases of the polygonal cells. (× 6.)

Fig. 7. An enlargement of the non-celluliferous side of a specimen, showing the form and comparative size of branches and dissepiments: the branches of this specimen are narrower than those of the frond from which figs. 5 and 6 were made. (× 6.)

Upper Helderberg group. *Walpole, Canada.*

Fenestella (Polypora) largissima.

Page 156.

Fig. 8. The non-celluliferous side of a frond, natural size.

Fig. 9. An enlargement of a portion of fig. 8, showing the form and comparative size of the non-celluliferous face of branches and dissepiments. (× 6.)

Upper Helderberg group. *Central New York.*

Fenestella propria.

Page 157.

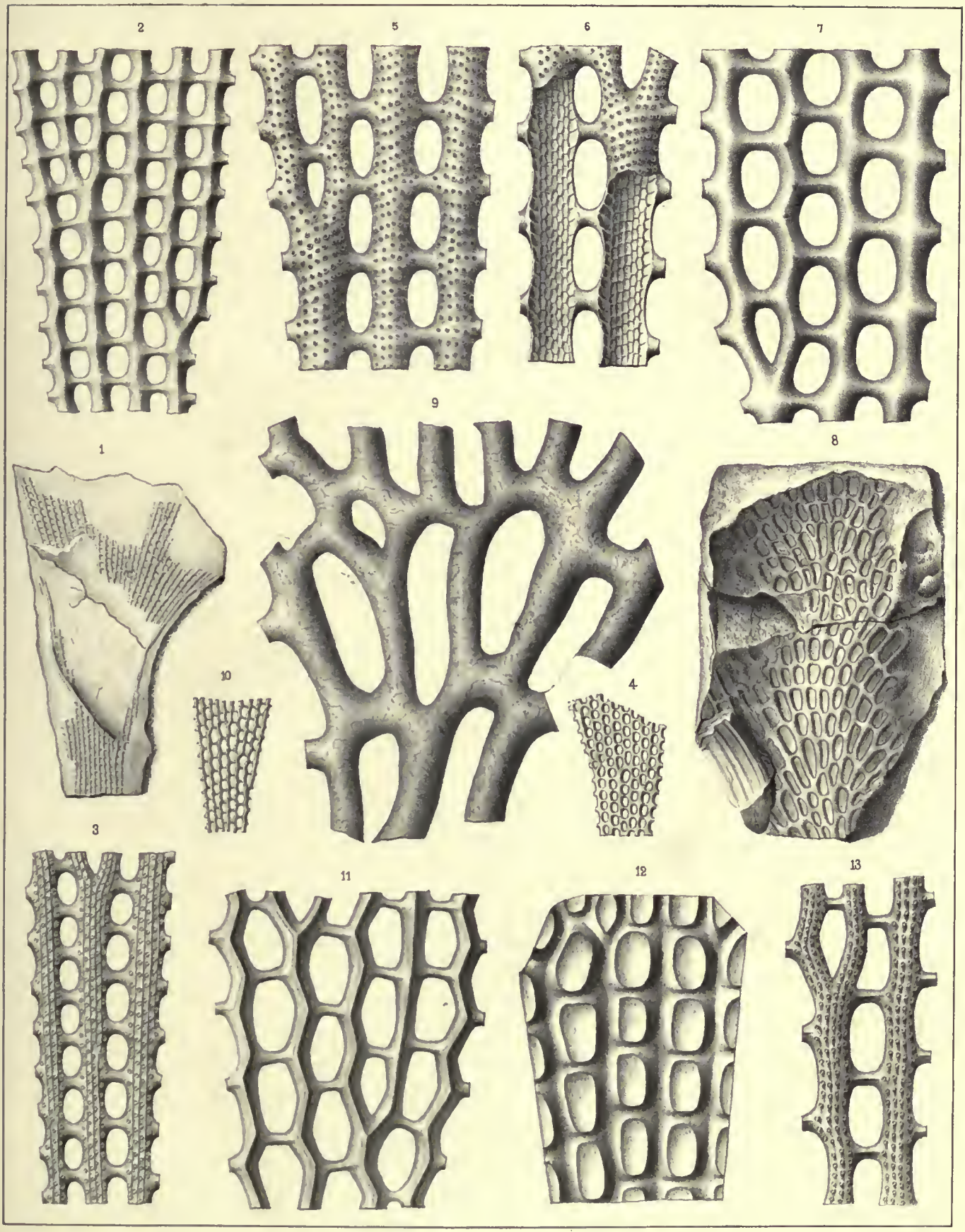
Fig. 10. A portion of the non-celluliferous face of a frond, natural size.

Fig. 11. An enlargement of a portion of fig. 10, showing the character of the non-celluliferous face of a frond. (× 6.)

Fig. 12. An enlargement of an impression of the non-celluliferous face of a frond. (× 6.)

Fig. 13. An enlargement of a portion of the celluliferous face of a frond, showing the form and arrangement of cell apertures and the carinated dissepiments. (× 6.)

Upper Helderberg group. *Near Buffalo, N. Y.*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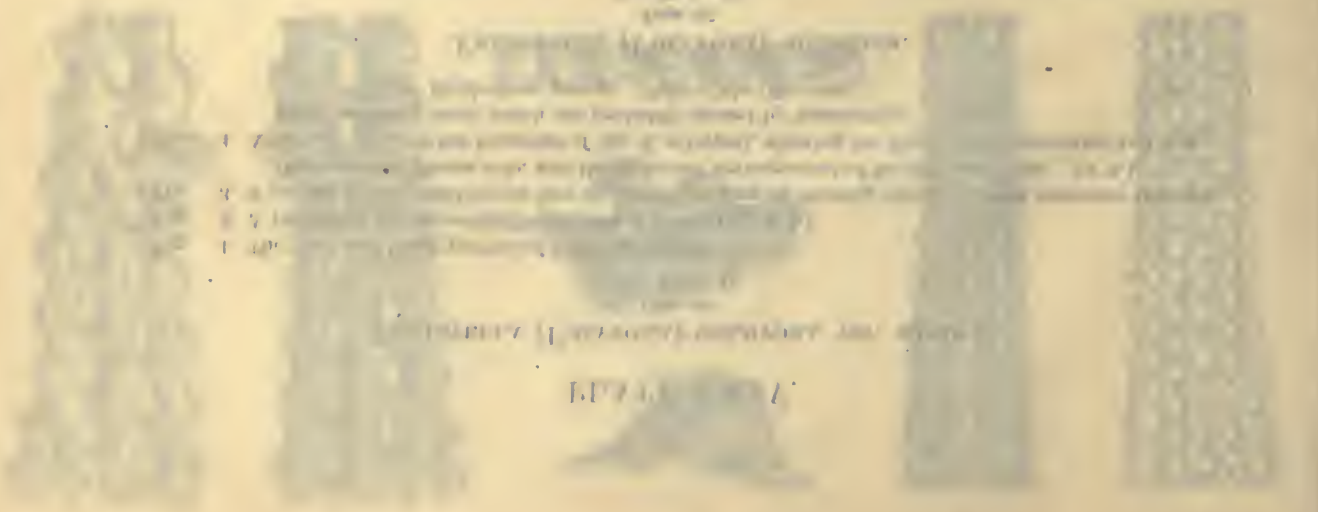

PLATE XXXV.

Fenestella (Polypora) celsipora, var. minima.

Page 151.
See Plate 41.

Fig. 1. The base and lower portion of a frond, natural size.

Fig. 2. A portion of the non-celluliferous face of a frond. (× 6.)

Fig. 3. A portion of the celluliferous face of a frond, enlarged, showing the fenestrules narrower than on the non-celluliferous side, and the form and arrangement of the cell apertures. (× 6.)

Fig. 4. A portion of one of the branches of fig. 3, enlarged, showing the form of cell apertures and marginal radiating lines, which are probably caused by weathering. (× 18.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Polypora) aculeata.

Page 157.
See Plate 40.

Fig. 5. A specimen, natural size, showing the spreading striated base and lower portion of the frond.

Fig. 6. An enlargement of the non-celluliferous face of the preceding, showing the form and nodose character of the branches.

Fig. 7. An enlargement of the celluliferous face of the same, showing the comparative size of the branches and dissepiments, the form and arrangement of cell apertures and the numerous spinules.

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Polypora) quadrangularis.

Page 158.
See Plates 36 and 40.

Fig. 8. The non-cellullferous face of a specimen, natural size.

Fig. 9. A portion of the celluliferous face of the preceding, enlarged, showing the comparative size of branches and fenestrules, the form and arrangement of cell apertures. (× 6.)

Fig. 10. A portion of the non-celluliferous side of the same, enlarged, showing comparative size of the branches and dissepiments, the carination of the branches and the less distinct carination of the dissepiments.

Fig. 11. An enlargement of one side of a branch, to show the form of the spines of the non-celluliferous face of the branches.

Fig. 12. A specimen, natural size, showing the base and lower portion of the frond, with numerous processes attached to, and growing upon a frond of *Fenestella (Unitrypa) stipata.*

Fig. 13. A portion of the celluliferous face of fig. 12, enlarged, showing the form and arrangement of the cell apertures and the prominent, irregular nodes. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Polypora) lævistriata, n. sp.

Page 159.

Fig. 14. A portion of the non-celluliferous face of a frond, natural size.

Fig. 15. An enlargement of a portion of the non-celluliferous side of fig. 14, showing the comparative size of the branches and dissepiments, and the angular and spinulose branches.

Fig. 16. An enlargement of a portion of the celluliferous face of fig. 14, showing the character of branches and dissepiments and the form and arrangement of the cell apertures.

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella, sp. indet.

Fig. 17. A specimen, showing the bases of several fronds, growing upon an overthrown individual of the same or another species.

Fig. 18. A specimen, showing the concentric aggregation of the substance as produced during the process of silification.

Upper Helderberg group.

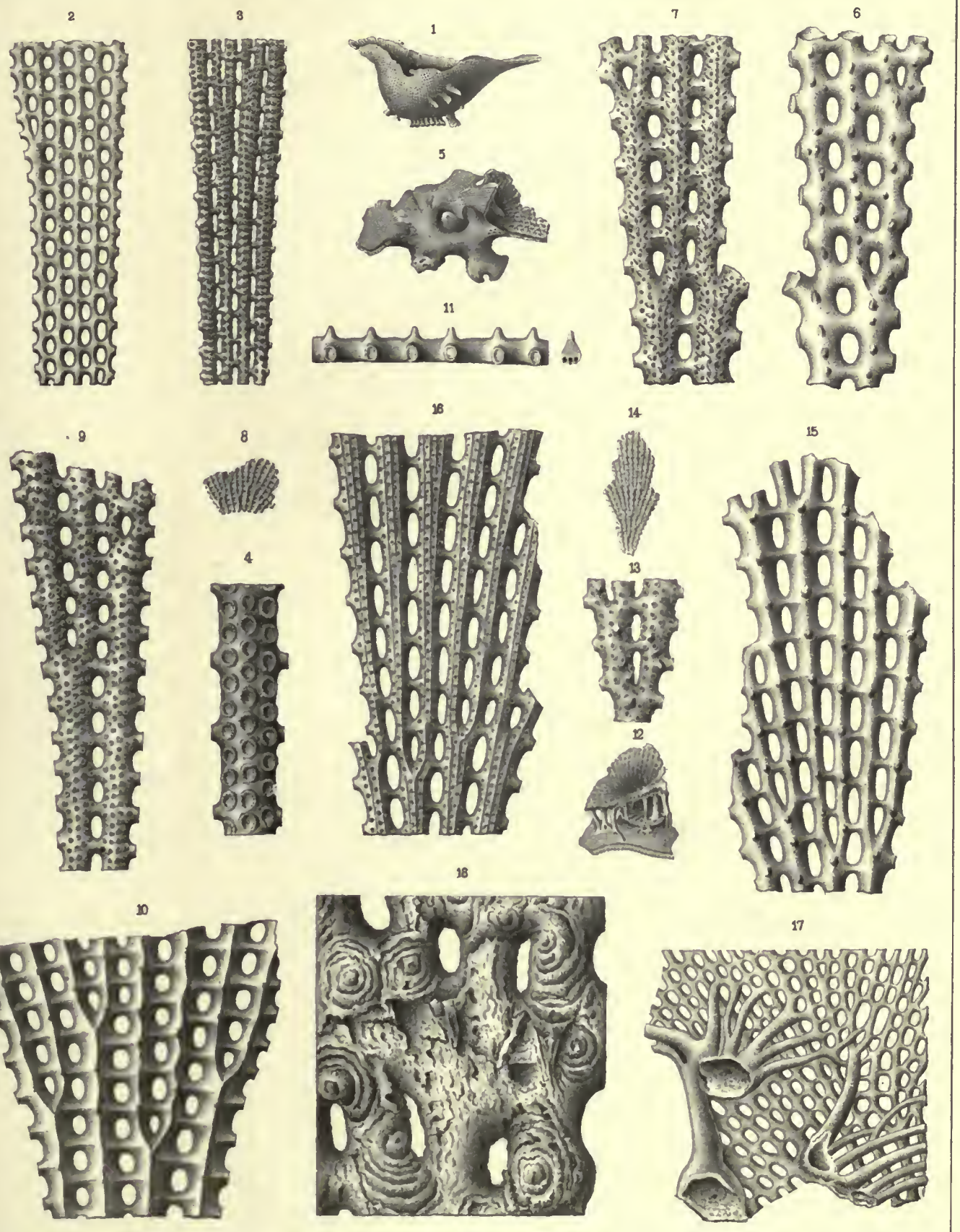

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PLATE XXXVI.

FENESTELLA, sp. indet.

Fig. 1. A fragment, showing the non-celluliferous face, natural size.

Fig. 2. A portion of the preceding, enlarged, showing the flat thickened branches.

Upper Helderberg group.

FENESTELLA (POLYPORA) CULTELLATA.

Page 160.

See Plate 41.

Figs. 3–8. Specimens, showing different forms of the elongated supporting processes which proceed from the frond and attach themselves to foreign bodies, forming an additional support to that afforded by the basal attachment.

Fig. 9. The sharply-striated, spreading base of a frond attached to a valve of *Atrypa reticularis*.

Fig. 10. An enlargement of a portion of a frond having unusually strong branches, which are anchylosed and solidified toward the margin. (× 2.)

Fig. 11. A portion of the frond having small fenestrules and flat branches and dissepiments.

Fig. 12. An enlargement of a portion of fig. 11. (× 6.)

Fig. 13. The non-celluliferous side of a portion of a frond, the branches of which have comparatively strong spinules.

Fig. 14. An enlargement of the preceding, showing more plainly the prominent oblique spinules, and comparative size of the branches and dissepiments. (× 6.)

Fig. 15. A portion of the celluliferous face of a frond, natural size.

Fig. 16. An enlargement of a portion of fig. 15, showing the fenestrules much narrower than on the non-celluliferous side, the form and arrangement of the cell apertures, the channeled character of the dissepiments and, on a portion of the figure, the central row of sharp, elongate, cuneiform nodes. (× 6.)

Fig. 17. The celluliferous side of another specimen, natural size.

Fig. 18. An enlargement of a portion of fig. 17, showing the branches larger than in fig. 16; the cell apertures partially obsolete on some portions, the dissepiments not channeled, and a row of sharp, cuneiform elevations along the middle of each branch. (× 6.)

Fig. 19. A lateral view of one of the branches of fig. 17, to show, more distinctly, the character of the sharp elevations along the middle of the branch (enlarged.)

Fig. 20. The non-celluliferous face of a frond, natural size.

Fig. 21. An enlargement of a portion of fig. 20, showing more distinctly the character of the branches and dissepiments.

Fig. 22. An enlargement of another portion of the same. It differs from fig. 21, in having the fenestrules comparatively narrower and more elongate. The upper left hand portion of the figure shows the presence of strong lateral processes.

Upper Helderberg group. *Falls of the Ohio river.*

FENESTELLA QUADRANGULARIS.

Page 158.

See Plates 35 and 40.

Fig. 23. A portion of a frond, natural size.

Fig. 24. An enlargement from the preceding, showing the angular branches and the strong nodes or spinules.

Upper Helderberg group. *Falls of the Ohio river.*

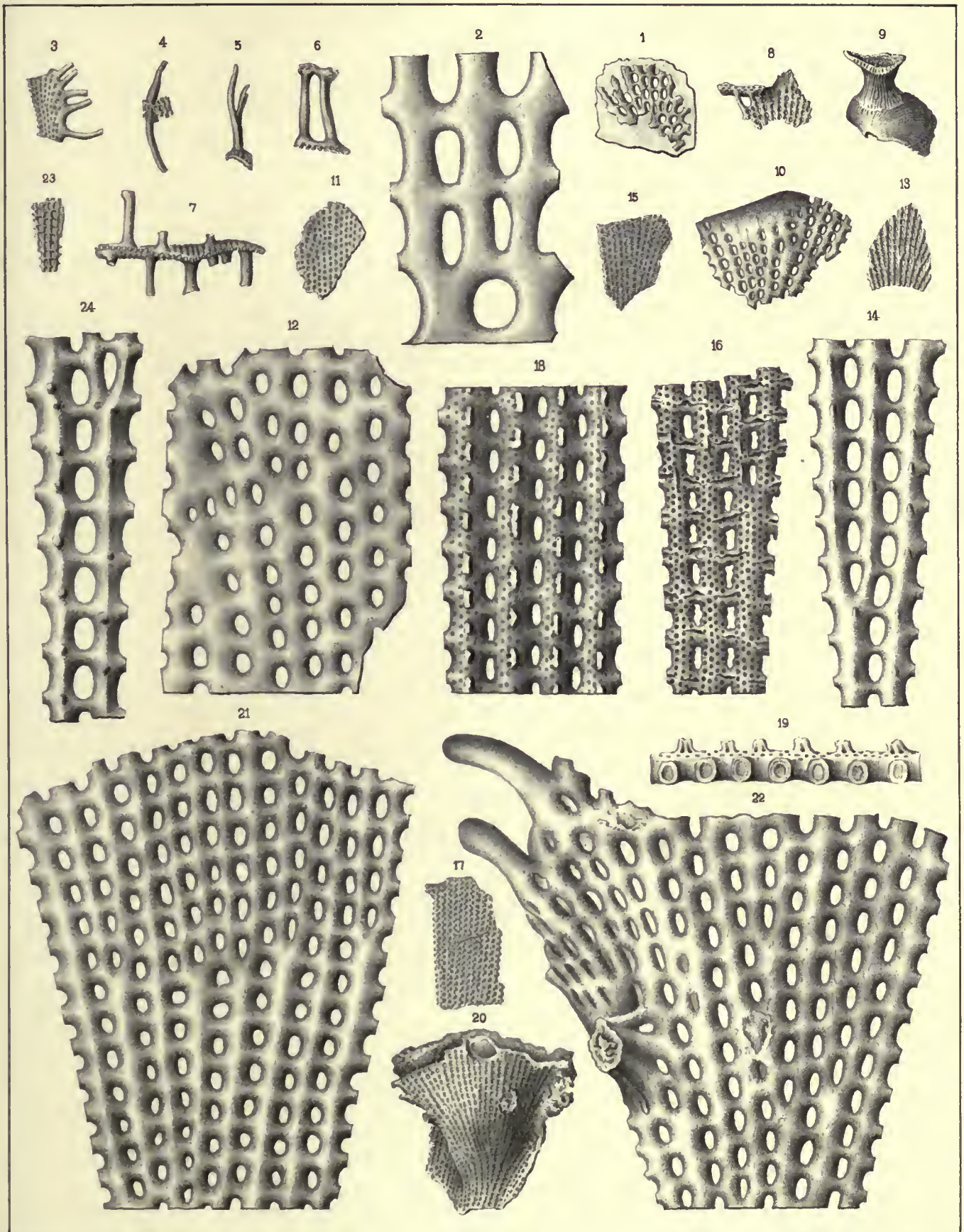
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PLATE XXXVII.

FENESTELLA (POLYPORA) ROBUSTA.

Page 156.
See Plates 34, 39 and 46.

Fig. 1. An enlargement of the non-celluliferous face, showing decidedly angular and carinated branches and dissepiments. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

FENESTELLA (POLYPORA) DISTANS.

Page 161.
See Plate 44.

Fig. 2. An enlargement of a portion of fig. 3, showing more distinctly the form of the branches, the prominent distant nodes and fine indistinct striations. (× 6.)

Fig. 3. The non-celluliferous face of a frond, showing the size of branches and dissepiments, and mode of growth.

Fig. 4. An enlargement of the non-celluliferous face of another specimen; as compared with fig. 2, the branches are more slender and destitute of nodes, and the striations are stronger. (× 6.)

Fig. 5. A portion of the celluliferous face of a specimen, enlarged, showing the form and arrangement of the cell apertures and the intermediate interrupted striæ. (× 6.)

Fig. 6. The non-celluliferous side of a specimen, natural size.

Fig. 7. A portion of fig. 6, enlarged, showing more distinctly the character of the branches and dissepiments, and the fine indistinct striation of the branches. (× 6.)

Fig. 8. An enlargement of a portion of the celluliferous face of another specimen, showing the form and arrangement of the cell apertures and the indistinct intermediate striæ; the elevated margins of the cell apertures are obliterated by weathering or maceration. (× 6.)

Fig. 9. The celluliferous face of another specimen, natural size.

Fig. 10. An enlargement of a portion of fig. 9; the specimen is much more macerated than that represented by fig. 8, the branches flatter and the cell apertures open obliquely; the dissepiments are channeled.

Fig. 15. A specimen, natural size, showing the arrangement of the branches and dissepiments, and their manner of growth.

Fig. 16. An enlargement of a portion of fig. 15, showing more distinctly the character of the branches and dissepiments, and their comparative size. (× 6.)

Upper Helderberg group. *Near Buffalo, N. Y.*

FENESTELLA (POLYPORA) FLABELLIFORMIS.

Page 161.

Fig. 11. The celluliferous face of a frond, natural size, showing the disposition of branches and dissepiments, and manner of growth.

Fig. 12. An enlargement of a portion of fig. 11, showing more distinctly the comparative size of the branches and dissepiments. The branch on the right is in a perfect condition, and shows the form and arrangement of the cell apertures, the comparatively strong ridges separating the ranges of apertures, and the interrupted striations. The surface of the other branch has been macerated and removed, showing the polygonal cells below. (× 6.)

Upper Helderberg group. *Onondaga Valley, N. Y.*

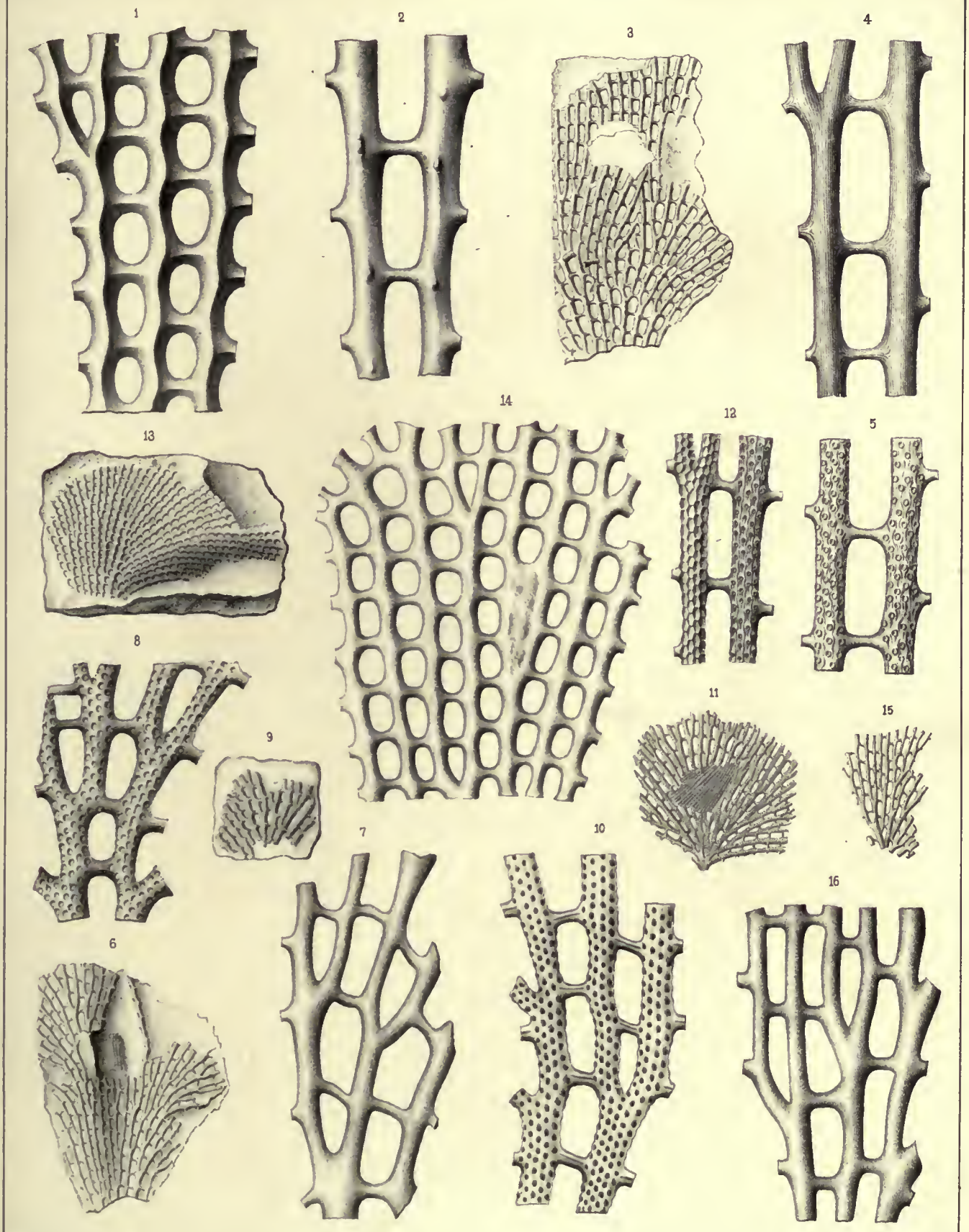
FENESTELLA (POLYPORA) PERANGULATA.

Page 162.

Fig. 13. The non-celluliferous face of a frond, showing the disposition of the branches and dissepiments, and mode of growth.

Fig. 14. An enlargement of a portion of the preceding. (× 6.) The branches should appear more angular than is represented in the figures.

Upper Helderberg group. *Western New York.*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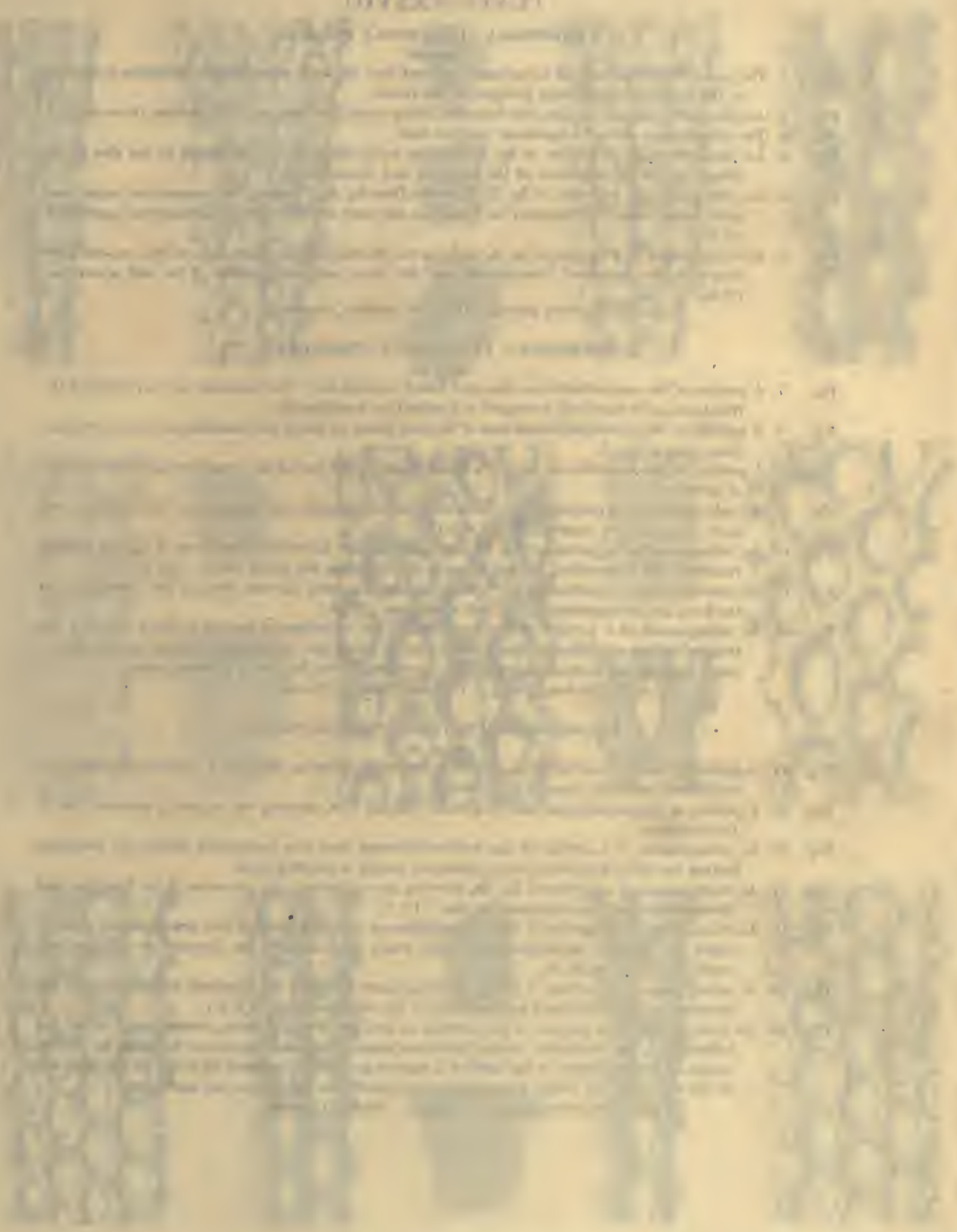

PLATE XXXVIII.

Fenestella (Polypora) porosa.

Page 163.

Fig. 1. The non-celluliferous side of a specimen, natural size, showing considerable variation in the size of the branches on different portions of the frond.

Fig. 2. Another specimen, natural size, the branches being nearly uniform and smaller than those of fig. 1.

Fig. 3. The celluliferous side of a specimen, natural size.

Fig. 4. An enlargement of a portion of fig. 1, showing more distinctly the variation in the size of the branches, and the character of the branches and dissepiments. (× 6.)

Fig. 5. An enlargement of a portion of fig. 2. It varies from fig. 4 in having the fenestrules larger and much wider than the branches; the branches are more angular and occasionally sub-carinated. (× 6.)

Fig. 6. An enlargement of a portion of fig. 3, showing the fenestrules narrower than on the non-celluliferous side, the carinated dissepiments and the form and arrangement of the cell apertures. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

Fenestella (Polypora) perundata.

Page 163.

Fig. 7. A portion of the non-celluliferous face of a frond, natural size; the branches over a portion of the frond are quite regularly arranged and united by anastomosis.

Fig. 8. A portion of the non-celluliferous face of another frond, in which the branches are more irregular than those of fig. 7.

Fig. 9. A portion of the celluliferous face of a frond, showing the size of the branches and their manner of growth.

Fig. 10. An enlargement of a portion of fig. 7, showing more distinctly the character of the branches and their connection by anastomosis. (× 6.)

Fig. 11. An enlargement of a portion of fig. 8; the branches are narrower than those of fig. 10, usually rounded; the fenestrules, in proportion to the branches, are much wider. (× 6.)

Fig. 12. An enlargement of a portion of fig. 9, showing the regularly sinuous form of the branches, and the form and arrangement of the cell apertures. (× 6.)

Fig. 13. An enlargement of a portion of two branches of the celluliferous face of a frond, showing the triangular non-celluliferous space immediately below the bifurcations, which extends downward between the central ranges of cell apertures, in the form of a narrow groove.

Upper Helderberg group. *Walpole, Ontario, Canada.*

Fenestella (Polypora) hexagonalis.

Page 161.

Fig. 14. A portion of the non-celluliferous face of a specimen, showing the size of the branches and dissepiments, and their manner of growth.

Fig. 15. A portion of the celluliferous face of a frond, natural size, showing the regularly sinuous form of the branches.

Fig. 16. An enlargement of a portion of the non-celluliferous face of a macerated frond, the branches having lost their angularity, and presenting simply a rounded form.

Fig. 17. An enlargement of a portion of fig. 14, showing more distinctly the character of the branches and dissepiments and their comparative size. (× 6.)

Fig. 18. An enlargement of a portion of the non-celluliferous face of a frond. The branches and dissepiments are partially imbedded in the rock, which gives to them the appearance of being narrower than they really are. (× 6.)

Fig. 19. An enlargement of a portion of fig. 15, showing more distinctly the regularly sinuous form of the branches, and the form and arrangement of the cell apertures. (× 6.)

Fig. 20. An enlargement of a portion of the surface of another frond, showing, immediately below the bifurcations, the triangular non-celluliferous space continued downward between the central ranges of cell apertures in the form of a narrow groove. Compared with fig. 19, the branches of this specimen are wider, not angular; the fenestrules are longer and narrower.

Upper Helderberg group. *Walpole, Ontario, Canada.*

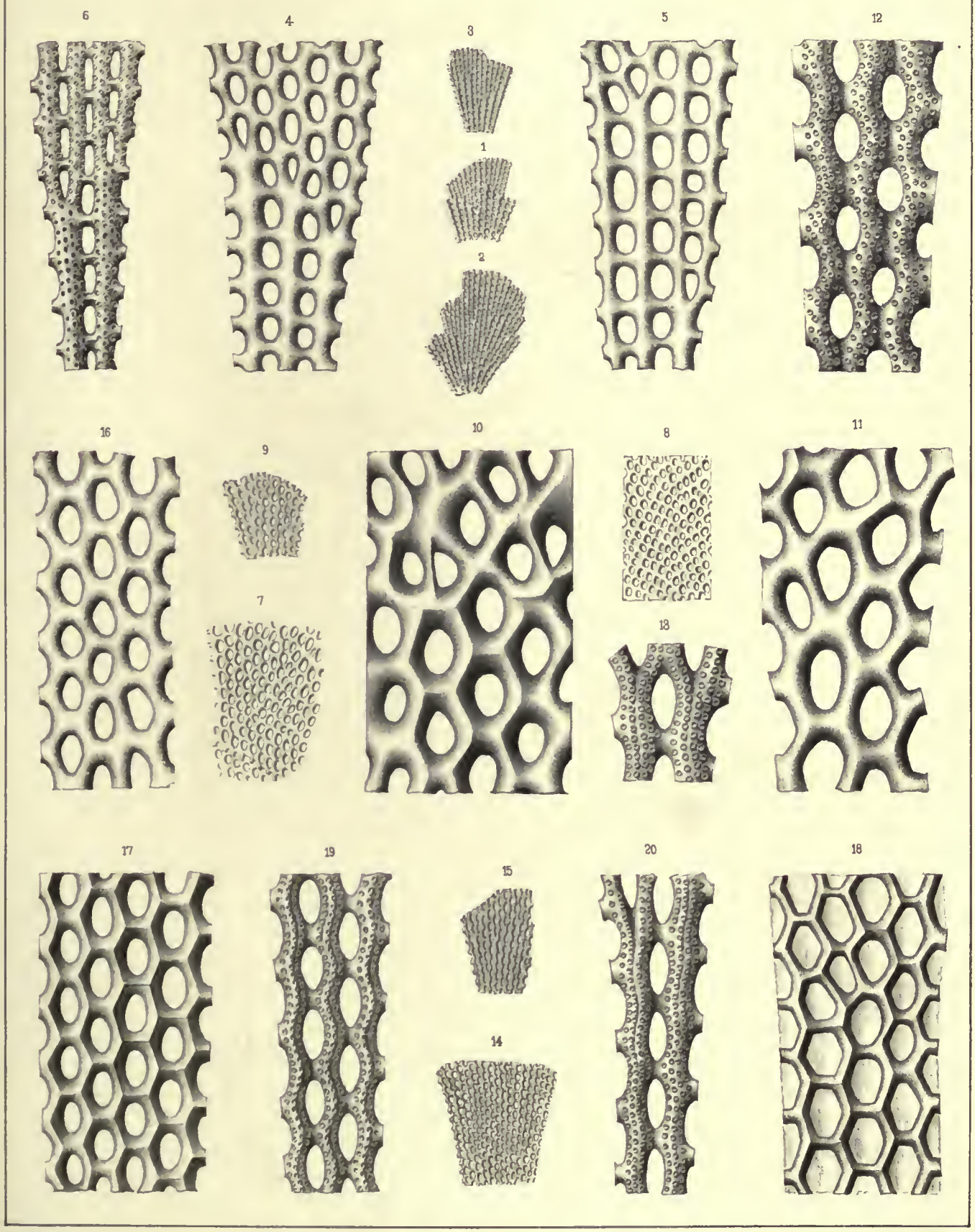
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PLATE XXXIX.

Fenestella (Polypora) robusta.

Page 156.

See Plates 34, 37 and 46.

Fig. 1. A specimen, natural size, showing angular branches and dissepiments.

Fig. 2. An enlargement of a portion of the non-cellnliferous face of a macerated frond, showing the texture of the solid portion of the branches. The lower portion of one of the branches is still further worn away, showing the bases of the polygonal cells.

Fig. 3. An enlargement of a portion of fig. 1, showing more distinctly the character of the branches and dissepiments, when in their natural condition.

Upper Helderberg group. *Walpole, Ontario, Canada.*

Fenestella (Polypora) nexa.

Page 165.

Fig. 4. A portion of the non-celluliferous face of a frond, showing the size of branches and dissepiments, and their manner of growth.

Fig. 5. A portion of the celluliferous face of a frond, natural size.

Fig. 6. A portion of the non-celluliferous face of a frond, enlarged, showing angular branches, narrow dissepiments, and strong striations on two of the branches. (× 6.)

Fig. 7. An enlargement of a portion of fig. 4. The branches are regularly rounded, and slightly narrower than the fenestrules. (× 6.)

Fig. 8. An enlargement of the upper portion of fig. 4. The branches are very irregular, rounded, or carinated, and frequently less than one-half the width of the fenestrules. (× 6.)

Fig. 9. An enlargement of a portion of fig. 5, showing more distinctly the form and comparative size of the branches and dissepiments, the form and arrangements of the cell apertures and the longitudinal striæ on a portion of one branch. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

Fenestella (Polypora) separata.

Page 166.

Fig. 10. The celluliferous side of a specimen, natural size, showing the size of the branches and dissepiments, and their manner of growth.

Fig. 11. An enlargement of a portion of fig. 10, showing more distinctly the character of the branches and dissepiments, their comparative size; the form and arrangement of cell apertures, and the longitudinal striæ separating the ranges of apertures. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

Fenestella (Polypora) mutabilis.

Page 166.

Fig. 12. A portion of the non-celluliferous face of a frond, natural size.

Fig. 13. A portion of fig. 12 enlarged. The branches are strong, wider than the fenestrules, rounded, with a narrow carina along the middle. The upper portion of the branches is strongly striated, the dissepiments carinated. (× 6.)

Fig. 14. An enlargement of another portion of fig. 12; the branches are more irregular than those of fig. 13; not so strong and more angular; the dissepiments are angular. (× 6.)

Fig. 15. An enlargement of a portion of the celluliferous face of a frond, showing the form and comparative size of the branches and dissepiments, and the form and arrangement of the cell apertures. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

PLATE XXXIX—Continued.

FENESTELLA (POLYPORA) HEXAGONALIS var. FORAMINULOSA.

Page 165.

Fig. 16. A portion of the non-celluliferous face of a frond, natural size.

Fig. 17. A portion of the celluliferous face of a frond, natural size.

Fig. 18. An enlargement of a portion of fig. 16, showing the character and comparative size of the branches and dissepiments; on the right of the figure the dissepiments form the bases of branches growing at right angles to the others. (× 6.)

Fig. 19. An enlargement of a portion of fig. 17, showing the form and comparative size of the branches and dissepiments, the form and arrangement of the cell apertures, and the prominent nodes characteristic of this variety. (× 6.)

Fig. 20. An enlargement of another portion of fig. 17, showing the non-celluliferous space, immediately below the bifurcations, continued downward between the central ranges of cell apertures in the form of a gradually narrowing shallow groove. The fenestrules are somewhat wider than those of fig. 19. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

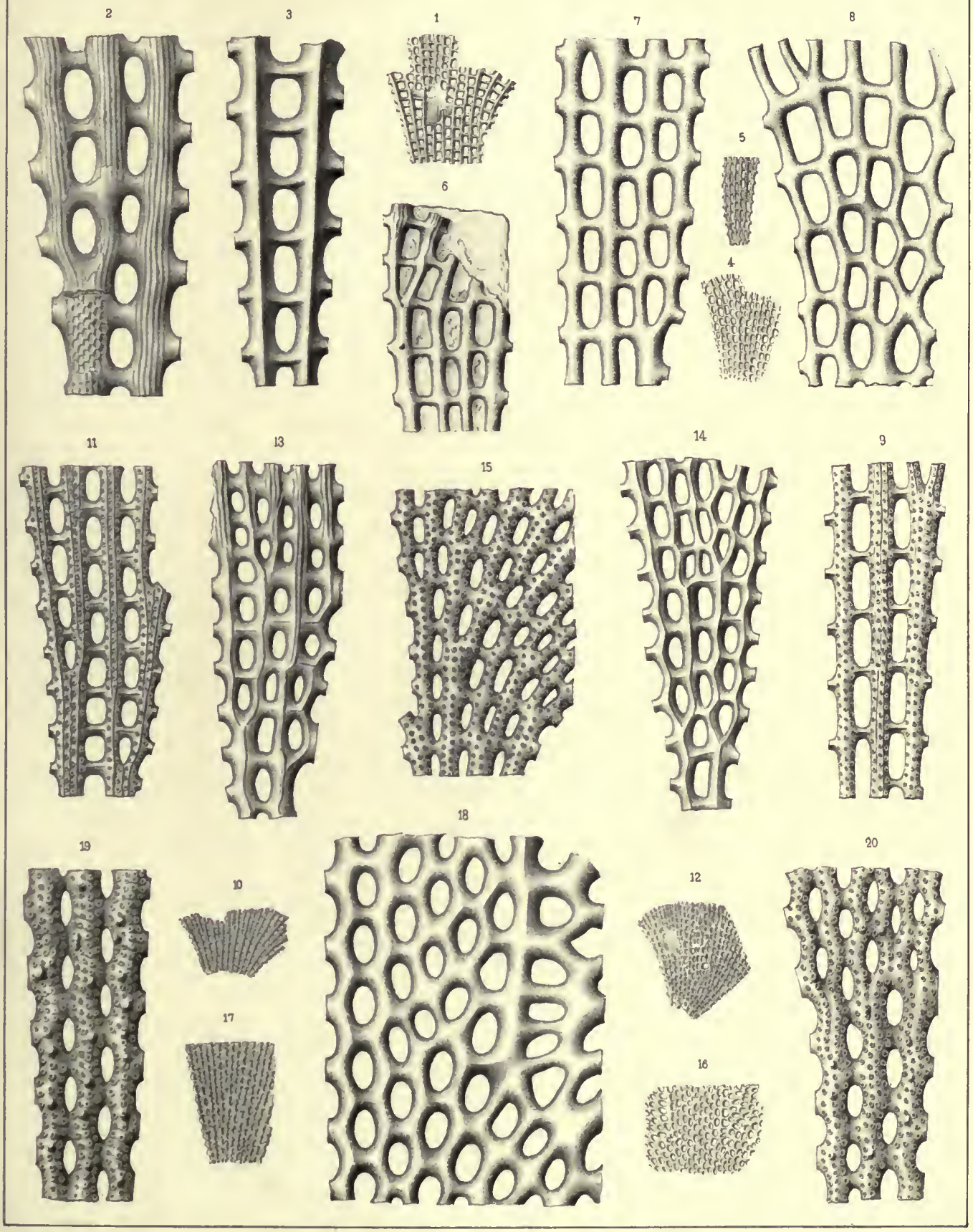
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PLATE XL.

Fenestella (Polypora) quadrangularis.

Page 158.

See Plates 35 and 36.

Fig. 1. A lateral view of a branch. (× 6.)

Fig. 2. A portion of the non-celluliferous face of a frond, distinctly showing the carinæ of the branches and dissepiments, and the nodes opposite the dissepiments. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Polypora) submutans.

Page 167.

Fig. 3. A portion of the non-celluliferous face of a frond, natural size.

Fig. 4. A portion of the preceding, showing comparatively regular branches, with dissepiments nearly equal in width to the branches. (× 6.)

Fig. 5. Another part of the same, showing more irregular branches and proportionally narrower dissepiments. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Polypora) aculeata.

Page 157.

See Plate 35.

Fig. 6. A portion of the non-celluliferous face of a frond, natural size.

Fig. 7. An enlargement of a portion of the non-celluliferous face. (× 6.)

Fig. 8. An enlargement from another frond, having stronger branches, wider dissepiments, and more numerous and prominent nodes. The fenestrules over a portion of the specimen are also more broadly oval. (× 6.)

Fig. 9. Transverse section of the branches of fig. 10, showing their form and the interior space occupied by the cells. (× 6.)

Fig. 10. A portion of the celluliferous face of a frond, showing the carinate branches and dissepiments, with nodes on the carinæ of the branches. (× 6.)

Fig. 11. A lateral view of one of the branches of fig. 10, showing the node-like spines on both the celluliferous and non-celluliferous faces. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Polypora) brevisulcata.

Page 168.

Fig. 12. The non-celluliferous face of a frond, natural size.

Figs. 13, 14, 15. Enlargements of different portions of fig. 12, showing the comparative size and character of the branches and dissepiments. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

Fenestella (Polypora) striatopora.

Page 168.

Fig. 16. Transverse section of the branches of fig. 17, showing their form and the space occupied by the cells. (× 6.)

Fig. 17. An enlargement of a portion of the non-celluliferous face of a frond, showing the comparative size and character of the branches and dissepiments. (× 6.)

Fig. 18. An enlargement of a portion of the celluliferous face of a frond where the elevated margins of one side of the cell apertures are very strongly developed. (× 6.)

Fig. 19. An enlargement from another portion of the same frond, showing the margins of the cell apertures more equally developed. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

PLATE XL—Continued.

Fenestella (Polypora) granilinea.

Page 151.

Fig. 20. The non-celluliferous face of a frond, natural size.

Fig. 21. A portion of the preceding, from near the base, showing branches wider than the fenestrules, and over the greater portion of the figure from two to three ranges of nodes. (× 6.)

Fig. 22. An enlargement of a portion of the same frond at a distance from the base, showing the branches slightly wider than the fenestrules, but more angular than those of the preceding figure, and having but one range of nodes, forming a nodulose carina along the middle of the branch. (× 6.)

Fig. 23. An enlargement from the celluliferous face of a frond, showing the comparative size of the branches and dissepiments, the carinate dissepiments, and the form and arrangement of the cell apertures. (× 6.)

Upper Helderberg group. *Ontario, Canada.*

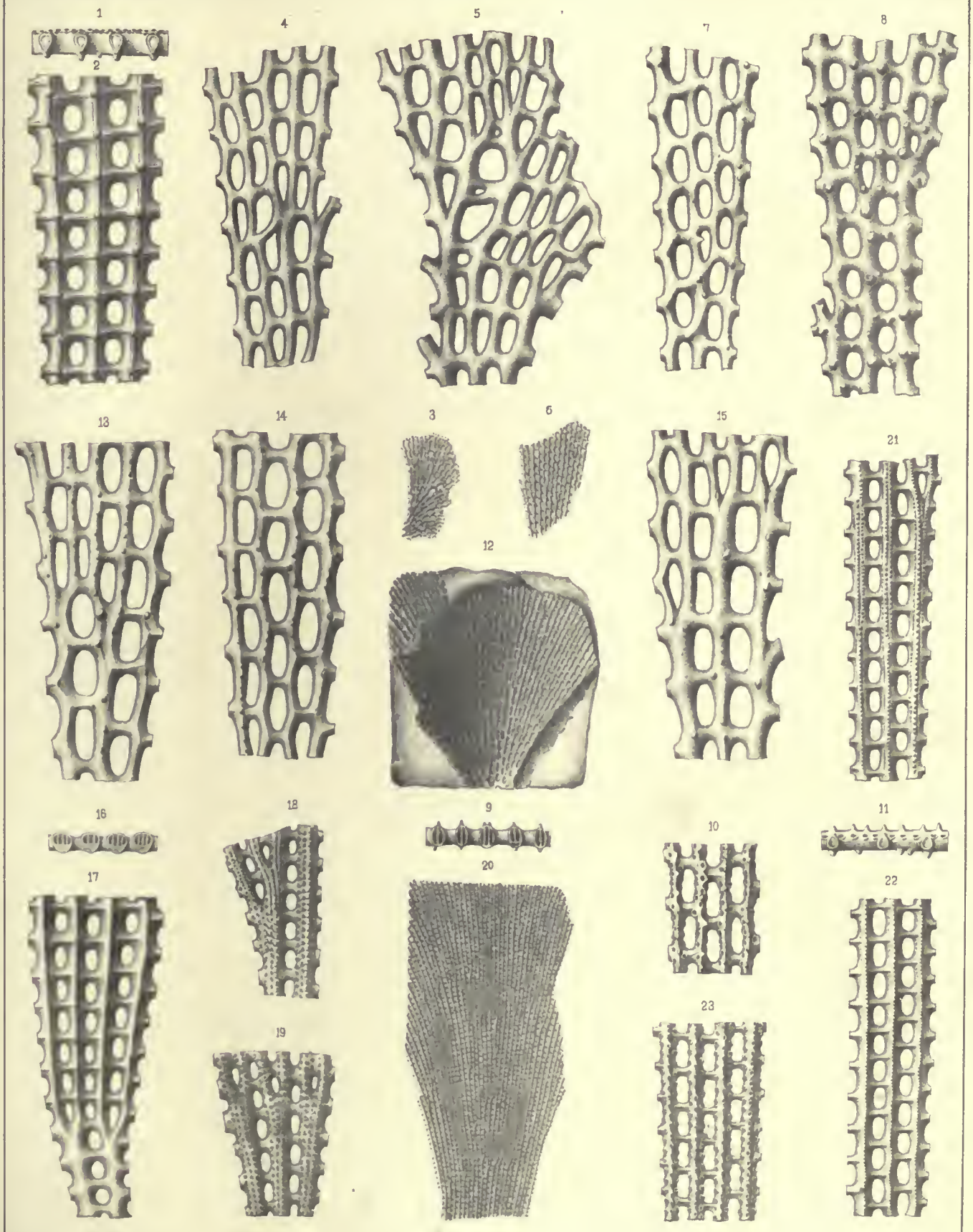
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PLATE XLI.

Fenestella (Polypora) adnata.

Page 152.

Fig. 1. A portion of the non-celluliferous face of a frond, natural size.

Fig. 2. The celluliferous face of fig. 1.

Fig. 3. A portion of the non-celluliferous face of a frond, having very irregular branches, with the dissepiments frequently wider than the branches. (× 6.)

Fig. 4. An enlargement from fig. 1, showing regular anastomosing branches with slender distinct carinæ along the middle. (× 6.)

Fig. 5. A portion of fig. 2, showing the character of the celluliferous face of the frond, the form and arrangement of the cell apertures and occasionally larger cell apertures. (× 6.)

Fig. 6. An enlargement of a portion of the non-celluliferous face of a frond, showing regular angular branches without carinæ, while the dissepiments are often carinated. (× 6.)

Fig. 7. A lateral view of one of the branches of fig. 1, showing the form of the dissepiments and the small spines on the celluliferous face. (× 6.)

Fig. 8. A portion of a non-celluliferous face of a frond, having very regular branches and strongly carinated dissepiments. (× 6.)

Fig. 10. A portion of a macerated frond, showing nearly equal, rounded branches and dissepiments, with circular or sub-circular fenestrules. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Polypora) cultellata.

Page 160.

See Plate 36.

Fig. 9. A portion of the celluliferous face of a frond, showing very distinctly the form and arrangement of the cell apertures and the sharp, securiform elevations along the middle of the branch. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Polypora) celsipora, var. minima.

Page 151.

See Plate 35.

Fig. 11. A portion of the celluliferous face of a frond, showing the cell apertures arranged in regular longitudinal rows, separated by narrow carinæ. (× 6.)

Fig. 12. The non-celluliferous face of a frond, showing quadrangular fenestrules wider than the branches. (× 6.)

Fig. 13. A portion of the non-celluliferous face of another specimen, showing circular fenestrules which are narrower than the branches. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Polypora) celsipora, var. minor.

Page 151.

Fig. 14. An enlargement of a portion of the non-celluliferous face of a frond, showing the comparative size and character of the branches and dissepiments. (× 6.)

Fig. 15. A portion of the celluliferous face of a frond. (× 6.)

Upper Helderberg group. *Ontario, Canada.*

PLATE XLI—Continued.

FENESTELLA (POLYPORA) CELSIPORA.

Page 150.

See Plate 42.

Fig. 16. A portion of the celluliferous face of a frond, showing the comparative size and character of the branches and dissepiments, the form and arrangement of the cell apertures and the ridges separating them. (× 6.)

Fig. 17. An enlargement from a gutta percha cast of the impression of the celluliferous face, where the tissue has been removed. (× 6.)

Fig. 18. The non-celluliferous face of a frond. The branch at the left is worn so that it presents a flattened appearance, filiform tissue, and the other branches are still more worn and the surface entirely removed, showing the fibrous condition of the solid portion of the branch. (× 6.)

Fig. 19. A portion of the celluliferous face. The branch on the right side of the figure shows the cell apertures in a perfect condition; the remaining branches have the surface macerated and the cells filled with solid matter, making them more prominent. (× 6.)

Fig. 20. A portion of the non-celluliferous face of a frond, showing considerable variation in the size and form of the fenestrules. (× 6.)

Fig. 21. A portion of a specimen, in which the branches are more slender than in the preceding; the fenestrules are quadrangular and frequently twice the width of the branches. (× 6.)

Fig. 22. A portion of the celluliferous face of a frond, showing the longitudinal rows of cell apertures, the elevation of the central row, the narrow fenestrules and angular dissepiments. (× 6.)

Upper Helderberg group. *Ontario, Canada.*

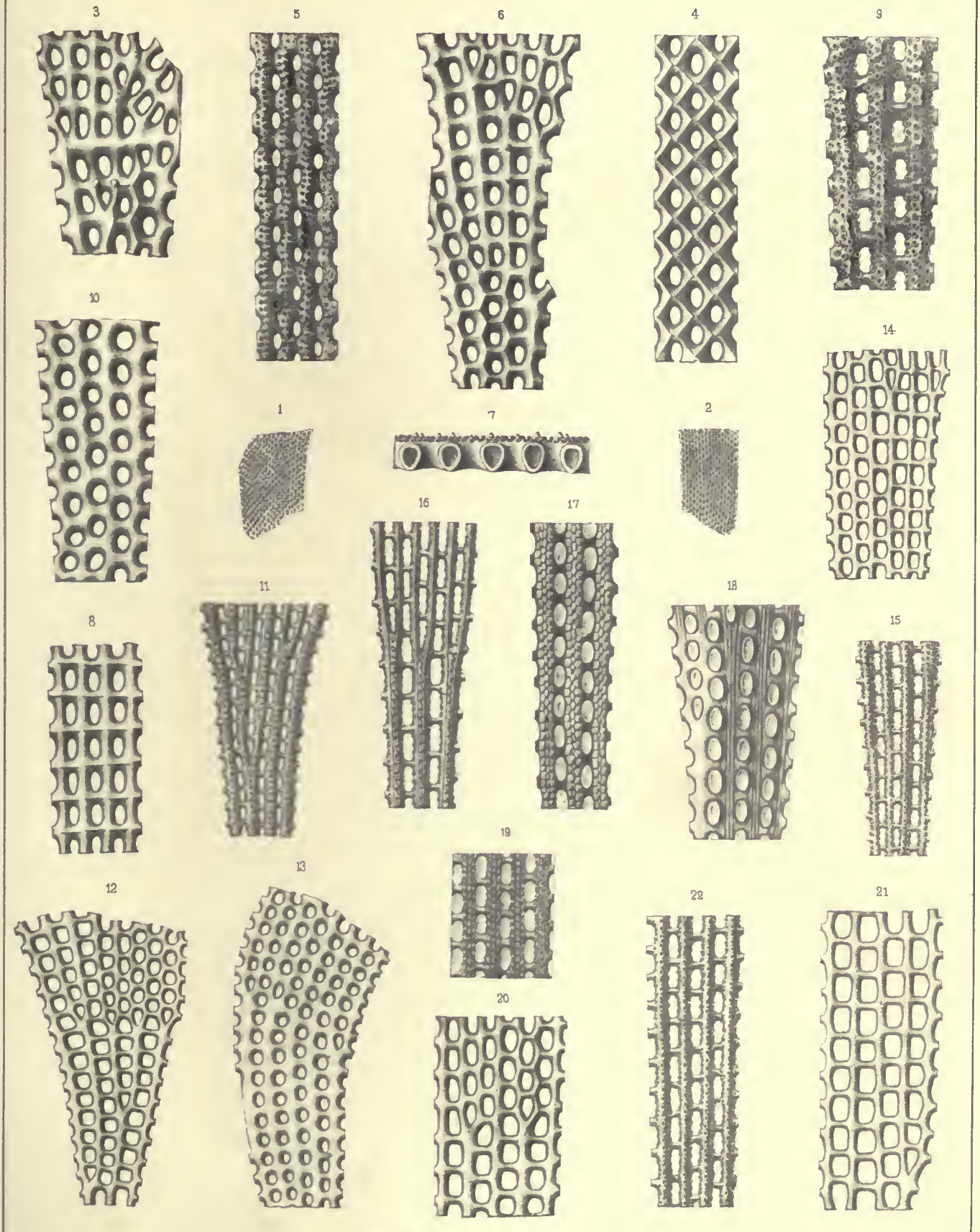
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PLATE XLII.

Fenestella (Polypora) carinella.

Page 153.

Fig. 1. An enlargement from the celluliferous face, showing the character and comparative size of the branches and dissepiments, the form and arrangement of the cell apertures, and the longitudinal carinæ separating the ranges of apertures. (× 6.)

Fig. 2. An enlargement from the non-celluliferous face of the frond, showing the comparative size and character of the branches and dissepiments, and the form of the fenestrules. (× 6.)

Upper Helderberg group. *Near Buffalo, N. Y.*

Fenestella (Polypora) elongata.

Page 153.

Fig. 3. An enlargement from the non-celluliferous face of a frond, showing the comparative size and character of the branches and dissepiments and the form of the fenestrules. (× 6.)

Fig. 4. An enlargement from the celluliferous face of a frond, showing the form and arrangement of the cell apertures, the continuous striæ between the ranges of apertures, and the intermediate interrupted striæ. The surface of the branch at the right is broken away, showing the form and arrangement of the cells (× 6.)

Upper Helderberg group. *Onondaga Valley, N. Y.*

Fenestella (Polypora) celsipora.

Page 150.

See Plate 41.

Fig. 5. The non-celluliferous face of a frond, natural size

Fig. 6. An enlargement of a portion of fig. 5. The branches have from three to five striations, and are from two to four times the width of the dissepiments, and from two to three times the width of the fenestrules. (× 6.)

Fig. 7. An enlargement of another portion of fig. 5. The branches are more slender than in the preceding figure, the fenestrules are sub-quadrangular, and their width is equal to or greater than that of the branches. (× 6.)

Fig. 8. An enlargement from the celluliferous face of a frond, showing the comparative size of the branches and dissepiments, the form and arrangement of the cell apertures, the carinæ separating the ranges of apertures, when more than two ranges occur, and appearing as a central carina where only two ranges occur. (× 6.)

Fig. 9. A fragment of the non-celluliferous face of a frond, natural size.

Fig. 10. An enlargement of a portion of fig. 9, showing the comparative size and character of the branches and dissepiments, and the quadrangular form of the fenestrules. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

Fenestella verrucosa.

Page 110.

See Plate 46.

Fig. 11. An enlargement from the non-celluliferous face of a frond, showing the comparative size and character of the branches and dissepiments. and the irregularly nodulose surface. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

PLATE XLII—Continued.

Fenestella (Polypora) lævinodata.

Page 169.

Fig. 12. A fragment of the non-celluliferous face of a frond, natural size.

Fig. 13. An enlargement of a portion of fig. 12. The branches are angular, sometimes carinated, very irregular and with comparatively strong, irregularly disposed nodes. (× 6.)

Fig. 14. An enlargement of another portion of fig. 12. The branches are regular; branches and dissepiments angular and carinated, with minute nodes on the carination of the branch opposite the dissepiments. (× 6.)

Fig. 15. An enlargement from the celluliferous face of a frond. The surface of the branch at the right is removed, showing the cellular interior and the form and arrangement of the cells. The contiguous branch has the surface partially worn away, showing the apertures of the cells very much enlarged, and but partially retaining their circular form. The remaining branches are in a perfect condition and show the form and arrangement of the cell apertures, the granules between the apertures, and, on the branch at the left, the comparatively strong ridges separating the longitudinal ranges of cell apertures. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella biseriata.

Page 113.

Fig. 16. A fragment of the non-celluliferous face of a frond, natural size.

Fig. 17. An enlargement of a portion of fig. 16, showing the comparative size and character of the branches and dissepiments, and the form of the fenestrules. (× 6.)

Fig. 18. An enlargement from the celluliferous face of a frond; the branches and dissepiments are angular and carinated; the cell apertures in two ranges. (× 6.)

Upper Helderberg group. *Cherry Valley, N. Y.*

Fenestella peculiaris.

Page 113.

Fig. 19. A fragment of the non-celluliferous face of a specimen, natural size.

Fig. 20. An enlargement of a portion of fig. 19. The surface has been macerated and the external markings are obsolete, the branches appearing flat. (× 6.)

Fig. 21. An enlargement of another portion of fig. 19. The upper portion is well preserved, showing the nodes as the most prominent feature. The branches of the lower part of the figure are in the same condition as those of fig. 20. (× 6.)

Upper Helderberg group. *Near Caledonia, N. Y.*

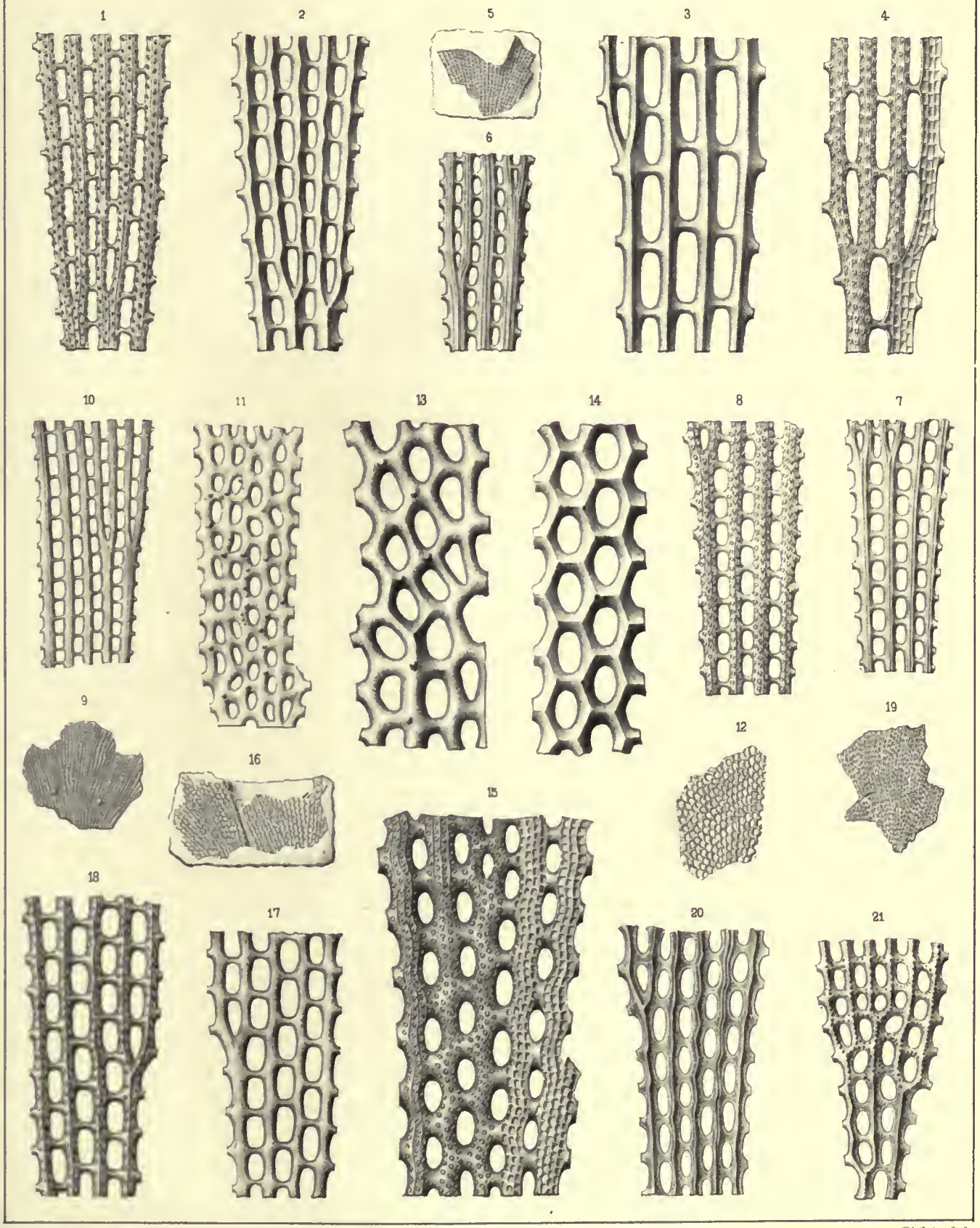
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PLATE XLIII.

Fenestella (Polypora) robusta.

Page 156.

See Plates 34, 37, 39 and 46.

Fig. 1. An enlargement of a portion of the celluliferous face, showing the rows of cell apertures separated by narrow ridges. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

Fenestella (Ptiloporina) conica.

Page 172.

Fig. 2. A nearly entire frond, natural size.

Figs. 3, 4. Enlargements from the preceding, showing the primary and secondary branches.

Upper Helderberg group. *Schoharie, N. Y.*

Fenestella (Ptiloporina) pinnata.

Page 172.

Fig. 5. A portion of a frond, natural size.

Fig. 6. An enlargement from the preceding, showing the striated branches and dissepiments.

Upper Helderberg group. *Schoharie, N. Y.*

Fenestella (Ptiloporina) disparilis.

Page 173.

Fig. 7. An enlargement of the non-celluliferous face of a frond. (× 6.)

Fig. 8. An enlargement from a decorticated specimen, showing the arrangement of the cells on the interior of the branches. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

Fenestella (Ptiloporina) sinistralis.

Page 174.

Fig. 9. The non-celluliferous face of a large portion of a frond, natural size, showing the disposition of the primary and secondary branches.

Schoharie grit. *Schoharie, N. Y.*

Fenestella (Polypora) rustica.

Page 169.

Fig. 10. A portion of the non-celluliferous face of a frond, natural size.

Fig. 11. An enlargement from the preceding. (× 6.)

Fig. 12. An enlargement of the celluliferous face, showing a weathered condition of the specimen. (× 6.)

Fig. 13. An enlargement showing the characters of the celluliferous face of the frond. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

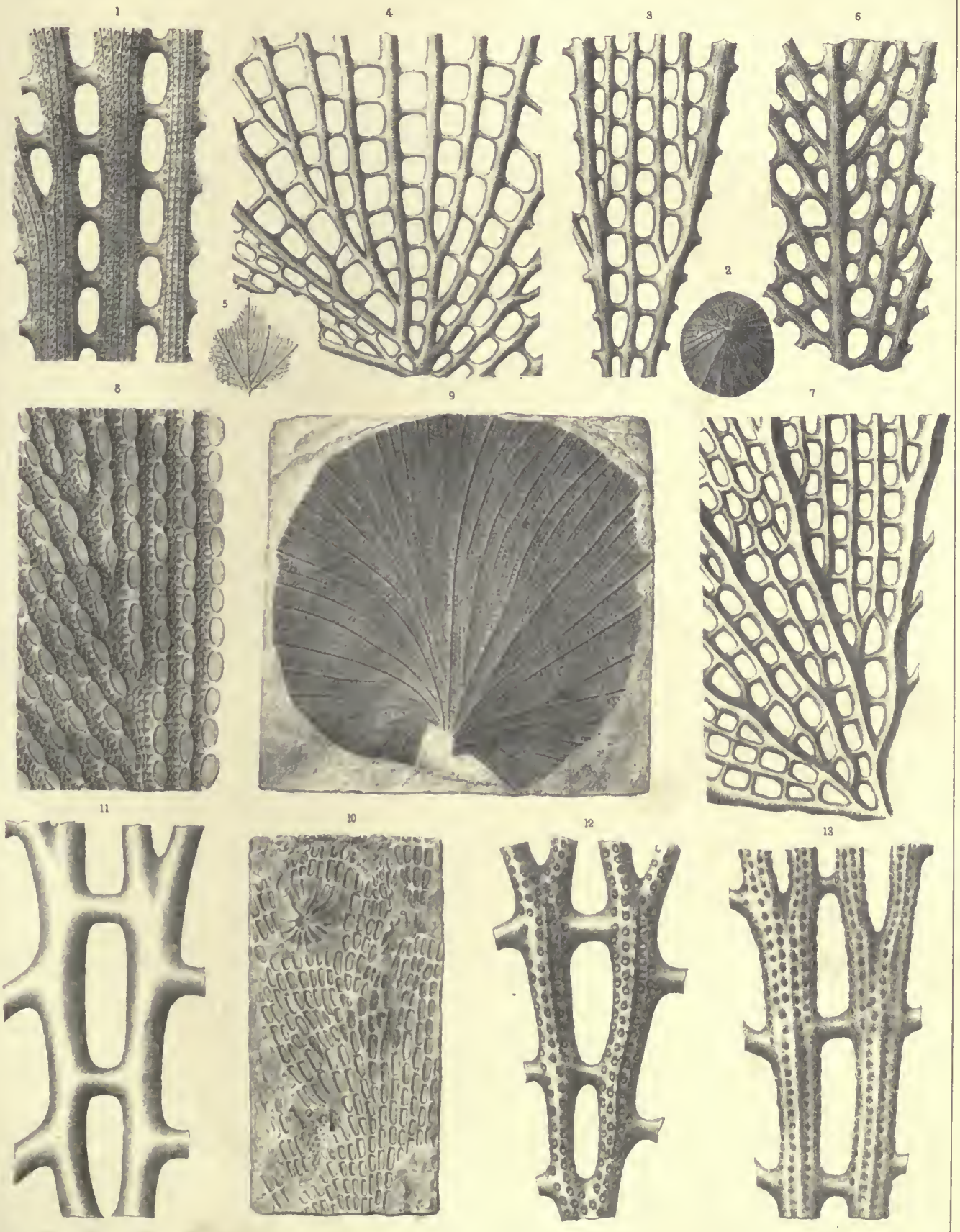
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PLATE XLIV.

Fenestella dispanda.

Page 114.

Fig. 1. A fragment, showing the comparative size of the branches and dissepiments and manner of growth, natural size.

Fig. 2. An enlargement of a portion of the non-celluliferous face of a frond. (× 6.)

Fig. 3. An enlargement of a portion of the celluliferous face of a frond, showing the form and arrangement of the cell apertures. (× 6.)

Fig. 4. An enlargement of a portion of the celluliferous face of another frond, showing a somewhat more lax mode of growth than the preceding specimen; the cell apertures are more widely separated, and the intermediate surface of the branch is finely striated. (× 6.)

Upper Helderberg group. *Western New York.*

Fenestella sinuosa.

Page 116.

Fig. 5. The celluliferous face of a frond, natural size.

Fig. 6. An enlargement of a portion of the same frond, showing the form and arrangement of the cell apertures and the sinuous carinæ. (× 6.)

Upper Helderberg group. *Near Caledonia, N. Y.*

Fenestella (Polypora) distans.

Page 161.

See Plate 37.

Fig. 7. A small fragment, showing the strong striated branches connected by slender dissepiments. (× 6.)

Upper Helderberg group. *Near Buffalo, N. Y.*

Fenestella parallela.

Page 107.

Fig. 8. A portion of a frond, natural size, showing the appearance of the non-celluliferous face under different degrees of weathering.

Fig. 9. A part of another well-preserved frond, natural size, showing angular branches and dissepiments.

Fig. 10. A lateral view of a branch without nodes. (× 6.)

Fig. 11. A lateral view of a branch, showing nodes perfectly preserved. (× 6.)

Fig. 12. A portion of the non-celluliferous face of a frond, showing angular branches and slightly curved dissepiments. (× 6.)

Fig. 13. A portion of the celluliferous face of a frond, without nodes. The elevated margins of the apertures being well preserved it is not probable that this specimen was ornamented with nodes. (× 6.)

Fig. 14. A portion of the celluliferous face of a frond, showing distinct nodes on the carinæ and oblique cell apertures with prominent elevated margins. (× 6.)

Fig. 15. A portion of the celluliferous face of a frond showing nodiferous carinæ, more prominent cell apertures, and generally a more robust appearance than either of the preceding specimens. (× 6.)

Fig. 16. A portion of the non-celluliferous face of a frond. This specimen has been so much weathered that the carinæ have disappeared, leaving a slight narrow channel along the middle of the branches. (× 6.)

Fig. 17. A specimen where the branches and dissepiments have been removed by solution. The illustration shows the filling of the fenestrules and cells. (× 6.)

Fig. 18. A portion of the non-celluliferous face of a frond, weathered so as to show the fibrous structure composing the more solid portion of the branches. (× 6.)

Upper Helderberg group. *Near Buffalo, N. Y.*

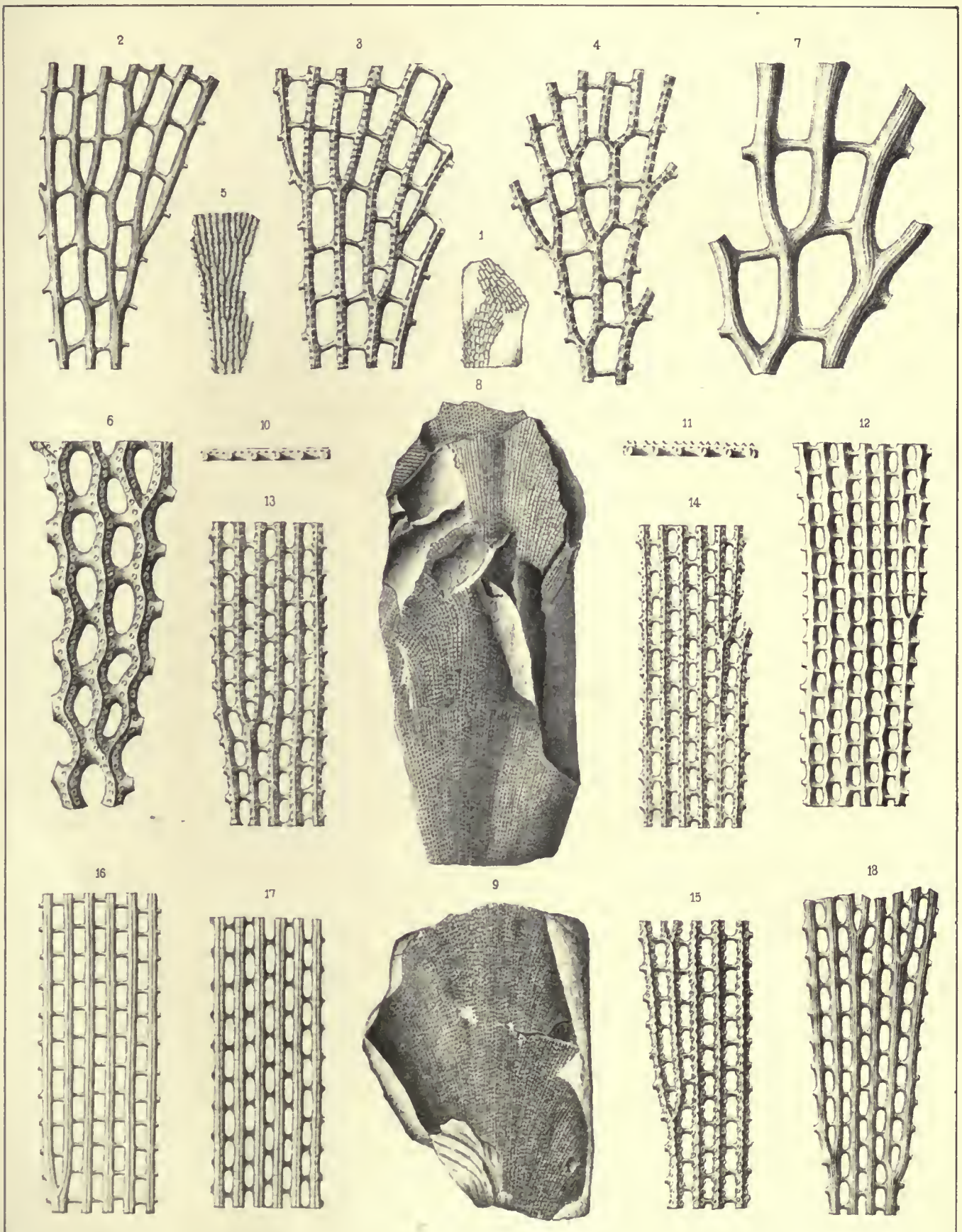
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PLATE XLV.

FENESTELLA VARIAPORA.

Page 104.

See Plate 35.

Fig. 1. A portion of a frond near the base, natural size.

Fig. 2. An enlargement of the preceding, showing more distinctly the shape of the frond, the elongate supporting processes near the base, the form and comparative size of the branches and dissepiments and the aspect of the fenestrules. (× 6.)

Fig. 3. An enlargement of a portion of the celluliferous face of the same frond, showing the form and arrangement of the cell apertures and the occasional large cells immediately below the bifurcations. (× 6.)

Fig. 4. An enlargement of another portion of the celluliferous face, showing angular and carinated branches. The carinæ are nodose, the nodes being essentially equal in number to the cell apertures. (× 6.)

Fig. 5. An enlargement of the celluliferous face of a frond; the cell apertures are obsolete, with the exception of a portion of one branch. (× 6.)

Fig. 6. An enlargement of a portion of the celluliferous face of a frond; the surface of the two branches at the left of the figure is worn away showing the interior of the cells; the remaining branches are still more deeply weathered, the cells being entirely worn away and the interior of the non-celluliferous portion of the branches exposed. (× 6.)

Fig. 7. An enlargement of a portion of a non-celluliferous face of a frond, showing very irregular branches, which have a width about equal to that of the dissepiments; the fenestrules vary in form from elongate-oval to circular. (× 6.)

Fig. 8. A portion of the non-celluliferous face of a frond, showing the branches much more regularly disposed than in the preceding figure. Over the greater portion of the specimen the fenestrules are nearly circular. (× 6.)

Fig. 9. An enlargement of the celluliferous face of the preceding, showing the form and arrangement of the cell apertures and the prominent nodes between the ranges; both the nodes and apertures are more closely arranged than on fig. 4. (× 6.)

Fig. 10. An enlargement of another portion of the celluliferous face of the same specimen, showing very large cell apertures occurring at irregular intervals, but invariably opposite a dissepiment. (× 6.)

Fig. 11. A lateral view of a branch, showing a transverse section of the dissepiments, the cell apertures and the form of the nodes along the middle of a branch. (× 6.)

Fig. 12. A lateral view of a branch from another frond where the nodes are obsolete. The dissepiments are more nearly circular in section and more distant than in fig. 11. (× 6.)

Fig. 13. A portion of the non-celluliferous face of a frond encrusted by other organisms. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

FENESTELLA STELLATA.

Page 109.

See Plate 47.

Fig. 14. An enlargement of a portion of the non-celluliferous face of a frond. (× 6.)

Fig. 15. An enlargement of a portion of the celluliferous face of the preceding, showing the form and arrangement of the cell apertures and the strong nodes along the middle of the branches. This specimen differs very much in appearance from the usual varieties of the species, but as every gradation between the two extremes occur, there are no means of separation from the typical forms. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

PLATE XLV—Continued

Fenestella depressa.

Page 111.

Fig. 16. An enlargement from the non-celluliferous face of a frond, showing the striated branches and the slender dissepiments, which are only about one-third the width of the branches, and very much depressed below their plane. (× 6.)

Fig. 17. A portion of the celluliferous face of the same specimen, showing the comparative size and character of the branches and dissepiments, and the form and arrangement of the cell apertures. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella tenella.

Page 105.

Fig. 18. A portion of the non-celluliferous face of a frond, showing the character of the branches and dissepiments, their comparative size and mode of growth. (× 6.)

Fig. 19. A portion of the celluliferous face of the same specimen, showing the form and arrangement of the cell apertures, and the comparatively strong nodes along the middle of the branch. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Polypora) crebescens.

Page 170.

Fig. 20. A fragment, natural size.

Fig. 21. A portion of the non-celluliferous face of a frond enlarged to six diameters, showing the distribution of nodes upon the surface.

Upper Helderberg group. *Western New York.*

Fenestella pertenuis.

Page 106.

Fig. 22. An enlargement of a portion of the non-celluliferous face of a frond, showing the comparative size and character of the branches and dissepiments and their mode of growth. (× 6.)

Fig. 23. A portion of the celluliferous face of the preceding, showing the form and arrangement of the cell apertures, the occasional larger apertures opposite the dissepiments and the prominent nodes along the middle of the branch. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

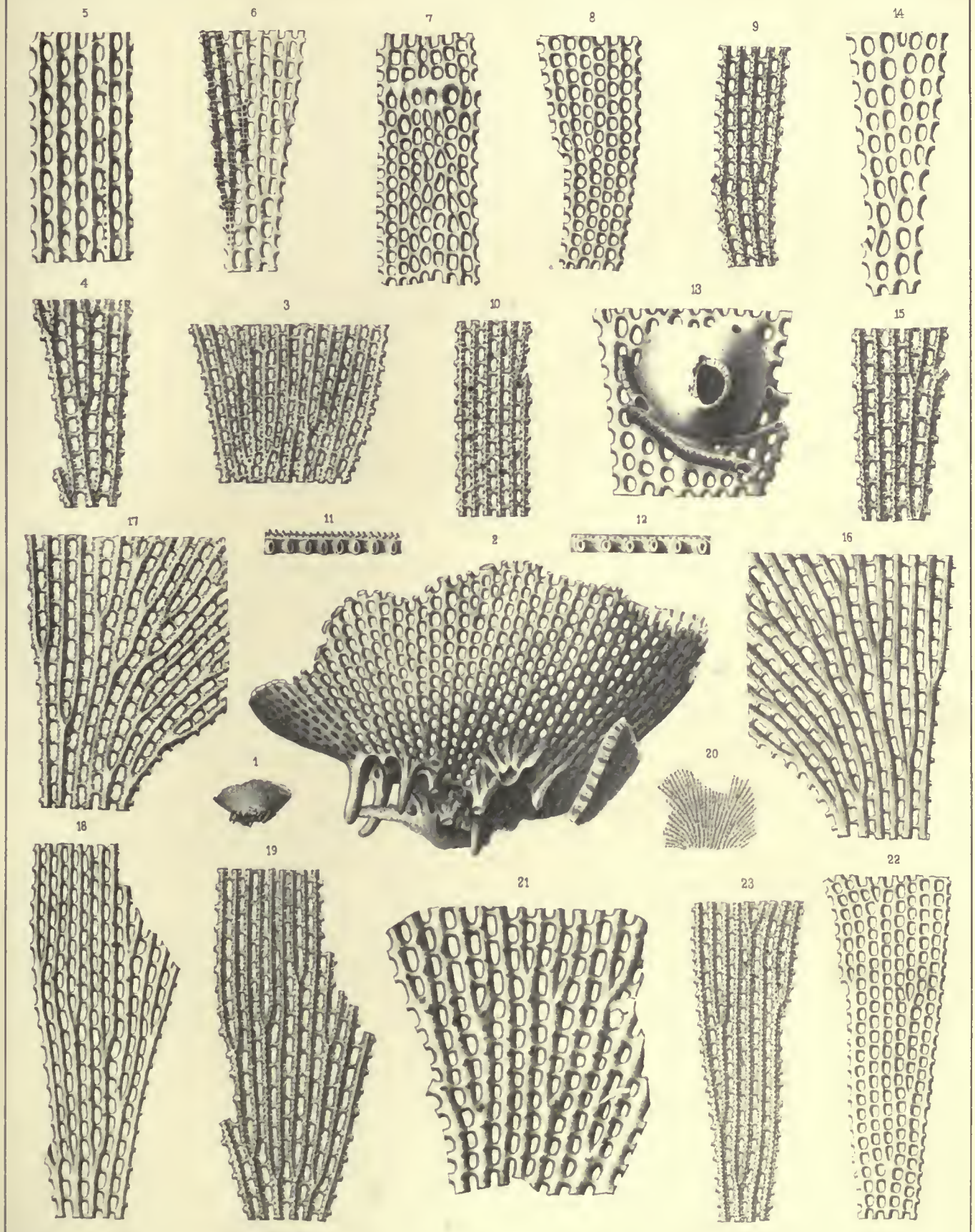

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PLATE XLVI.

FENESTELLA CURVIJUNCTURA.

Page 107.

Fig. 1. A figure, natural size, showing the mode of growth and the disposition of the branches and dissepiments.

Fig. 2. An enlargement from the preceding, shewing more distinctly the appearance of the branches and the curved dissepiments. (× 6)

Fig. 3. An enlargement from the celluliferous face, showing the form and disposition of the cell apertures. (× 6.)

Fig. 4. An enlargement of a lateral view of a branch, showing the oblique dissepiments, and the nodes on the middle of the branch. (× 6.)

Fig. 5. An enlargement of a transverse section of the branches. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

FENESTELLA (POLYPORA) ROBUSTA.

Page 156.

See Plates 34, 37, 39 and 43.

Fig. 6. An enlargement from the non-celluliferous face, showing very slender dissepiments, and both angular and striated branches. (× 6.)

Upper Helderberg group *Walpole, Ontario, Canada.*

FENESTELLA [PTILOPORINA ?] CONFERTIPORA.

Page 108.

Fig. 7. A fragment, natural size.

Fig. 8. An enlargement from a portion of the preceding, showing the ordinary slender branches and one of the larger branches. (× 6.)

Fig. 9. An enlargement from the celluliferous face, showing the circular, crowded cell apertures, and occasional larger apertures. (× 6.)

Fig. 10. An enlargement of a transverse section of several branches. (× 6.)

Fig. 11. An enlargement of a lateral view of a branch, showing the cell apertures and a section of the dissepiments. (× 6). See figs. 17–21.

Upper Helderberg group. *Falls of the Ohio river.*

FENESTELLA SINGULARITAS.

Page 114.

Fig. 12. A fragment, natural size.

Fig. 13. An enlargement from the preceding, showing more distinctly the appearance of the branches and dissepiments, and the conspicuous nodes below the bifurcations. (× 6.)

Fig. 14. An enlargement from the celluliferous face, showing the obtusely angular branches, prominent nodes, and the disposition of the cell apertures. (× 6.)

Fig. 15. An enlargement of a transverse section of several branches. (× 6.)

Fig. 16. An enlargement of a lateral view of a branch, showing sections of the dissepiments, the cell apertures and the distant nodes on the two surfaces. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

FENESTELLA [PTILOPORINA ?] CONFERTIPORA.

Page 108.

Fig. 17. A fragment, natural size.

Fig. 18. An enlargement from the preceding, showing more distinctly the form and disposition of the branches and dissepiments. (× 6.)

Fig. 19. An enlargement from the celluliferous face of a specimen more macerated than fig. 9. (× 6.)

Fig. 20. An enlargement of a transverse section of branches. (× 6.)

Fig 21. An enlargement of a lateral view of a branch, showing transverse sections of dissepiments, and the very prominent nodes upon the celluliferous face. (× 6). See figures 7–11.

Upper Helderberg group. *Falls of the Ohio river.*

PLATE XLVI—Continued.

FENESTELLA VERRUCOSA.

Page 110.

Fig. 22. An enlargement from the non-celluliferous face of a frond, showing irregular branches.

Fig. 23. An enlargement from the celluliferous face of a frond, showing the disposition of the cell apertures, and the nodes along the middle of the branch. (× 6.)

Fig. 24. An enlargement of a transverse section of the branches. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

FENESTELLA TUBERCULATA.

Page 116.

Fig. 25. A fragment, natural size.

Fig. 26. An enlargement from the preceding, showing more distinctly the form and disposition of the branches and dissepiments, and the prominent nodes. (× 6.) See figs. 33, 34.

Upper Helderberg group. *Walpole, Ontario, Canada.*

FENESTELLA ÆQUALIS.

Page 112.

Fig. 27. An enlargement from the non-celluliferous face. (× 6.)

Fig. 28. An enlargement from a specimen which has the celluliferous portion of the branches covered by a rock deposit; the carina, with prominent nodes alone being exposed. (× 6.)

Fig. 29. An enlargement of the lateral view of a branch, showing the nodes on the non-celluliferous face. (× 6.)

Fig. 30. An enlargement from the celluliferous face; the branch on the right has been macerated and the organic matter removed, leaving the siliceous filling of the cavity of the branch and of the cell tubes. (× 6.)

Fig. 31. An enlargement from the non-celluliferous face, the branches being partially imbedded in the rock. The branches are straight, sinuous or zig-zag, according to the position of the dissepiments, whether alternating or opposite. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

FENESTELLA TUBERCULATA.

Page 116.

Fig. 33. An enlargement of a lateral view of a branch. (× 6.)

Fig. 34. An enlargement from the non-celluliferous face, showing striated branches and prominent nodes. (× 6.) See figs. 25, 26.

Upper Helderberg group. *Walpole, Ontario, Canada.*

FENESTELLA PROCERITAS.

Page 115.

Fig. 32. A fragment, natural size.

Fig. 35. An enlargement from the non-celluliferous face. (× 6.)

Fig. 36. An enlargement from the celluliferous face. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

Palæontology of N.Y., Vol VI. Plate XLVI.

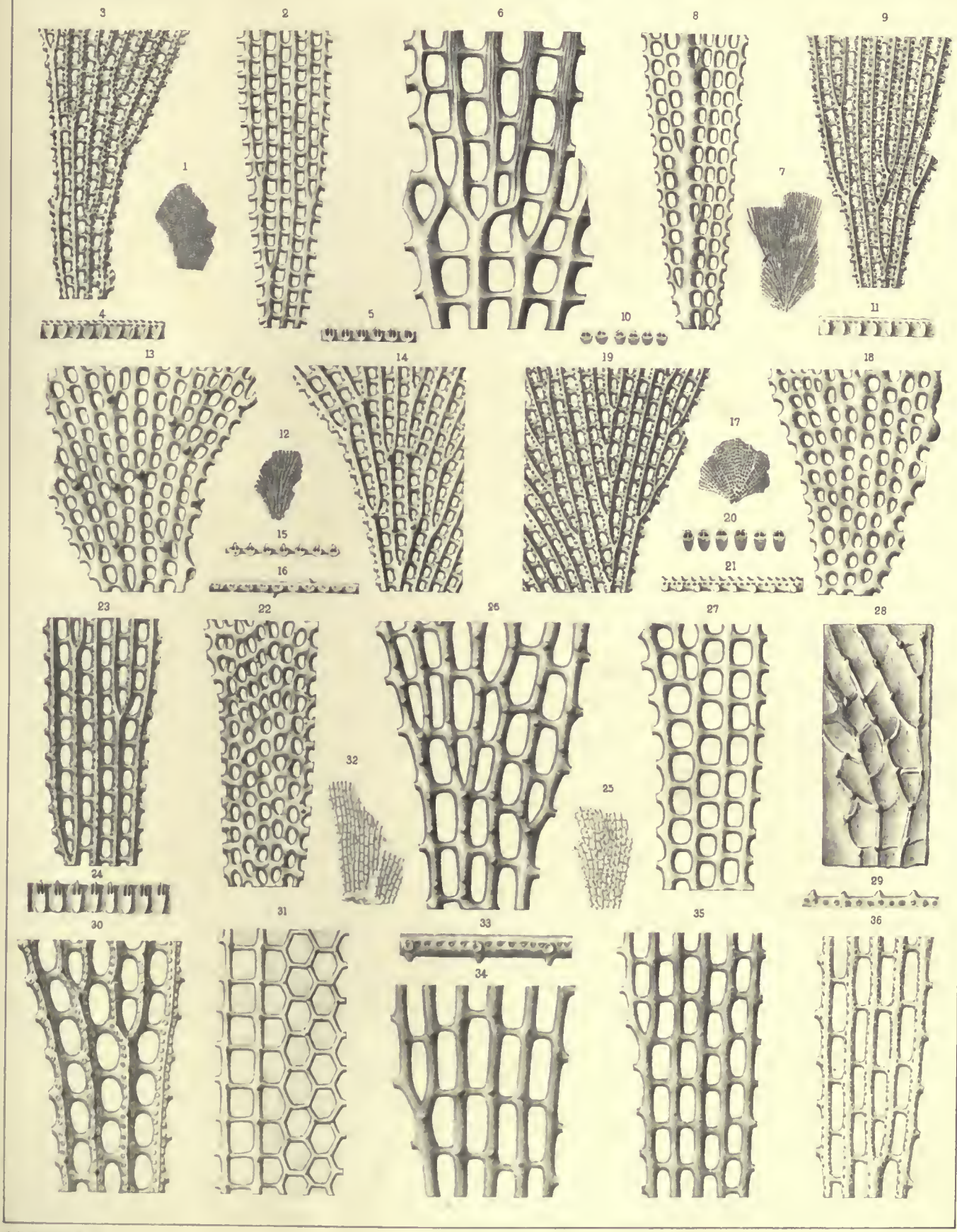

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PLATE XLVII.

Fenestella lunulata.

Page 121.

Fig. 1. An enlargement of a portion of the non-celluliferous face of a frond; the dissepiments are broad, curved and somewhat elevated above the branches, giving to the surface a peculiar appearance. The nodes upon the upper margins of the dissepiments are but moderately developed. (× 6.)

Fig. 2. An enlargement of a portion of the non-celluliferous face of a frond; the branches and dissepiments are flattened from maceration. (× 6.)

Fig. 3. An enlargement of a portion of the non-celluliferous side of a frond; the dissepiments and their nodes being so prominent as to in a measure obscure the branches. (× 6.)

Fig. 4. An enlargement of a portion of the non-celluliferous face of a frond; the crescentiform elevations on the dissepiments, and the more slender nodes on their upper margins. (× 6.)

Fig. 5. An enlargement of the expanded summits of the carinæ. (× 6.)

Fig. 6. An enlargement of a portion of the celluliferous face of a frond; the carinæ, having been removed, showing the form and arrangement of the cell apertures. (× 6.)

Figs. 7, 8, 9. Transverse sections of branches from different specimens, showing considerable variation in the comparative height and width.

Fig. 10. An enlargement of a lateral view of a branch, showing transverse section of oblique dissepiments, the height of the carina, and the cell apertures. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella serrata.

Page 110.

Fig. 11. An enlargement of a portion of the non-celluliferous face of a frond, having comparatively large, quadrangular fenestrules, slender dissepiments, and strong, spiniform nodes on the branches. (× 6.)

Fig. 12. An enlargement of a portion of the non-celluliferous face of another specimen, having smaller, more oval fenestrules, and comparatively much stronger branches, without nodes, though this may in a measure be due to maceration.

Fig. 13. An enlargement of a portion of the non-celluliferous side of a frond, having subangular fenestrules wider than the branches, the latter having numerous granules or small nodes, which are much less conspicuous than those shown in fig 11.

Fig. 14. An enlargement of a portion of the non-celluliferous face of a frond; the fenestrules are narrower than in figs. 11 and 13, the nodes numerous and more prominent than in fig. 13, though not as much so as in fig. 11. (× 6.)

Fig. 15. An enlargement of a portion of the celluliferous side of a frond, showing angular branches and the cells opening laterally, with the branches and dissepiments sharply angular. (× 6.)

Fig. 16. A lateral view of a branch enlarged, showing transverse section of dissepiments, cell apertures and nodes. (× 6.)

Fig. 17. An oblique view of a portion of the celluliferous face of a frond enlarged, showing the serrated appearance of the summits of the branches. (× 6.)

Fig. 18. A transverse section of the branches. (× 6.)

Fig. 19. An enlargement of a portion of the non-celluliferous surface of a frond, referred with doubt to this species. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

PLATE XLVII—Continued.

FENESTELLA STELLATA.

Page 109.

See Plate 45.

Fig. 20. An enlargement of the non-celluliferous face of a frond, having branches quite rapidly and broadly widening to the bifurcations, and with strong, oblique spiniform nodes. (× 6.)

Fig. 21. An enlargement from near the base of a specimen, with the branches very much thickened. (× 6.)

Fig. 22. An enlargement from the same specimen as fig. 20, but at a greater distance from the base, showing strongly striated, nodose branches. (× 6.)

Fig. 23. An enlargement, showing branches very gradually increasing in width, frequently of essentially the same size for their entire length, and regularly oval fenestrules which are slightly wider than the branches. (× 6.)

Fig. 24. An enlargement of a portion of the celluliferous face of a frond, showing numerous very large cell apertures, usually occurring near a dissepiment. (× 6.)

Fig. 25. An enlargement of an oblique view of a portion of the celluliferous face of a specimen, to show the appearance and height of the elevations along the middle of the branch. (× 6.)

Fig. 26. A lateral view of a branch enlarged, showing the nodes, and narrow dissepiments at right angles to the axis of the branch. (× 6.)

Fig. 27. A lateral view of a branch enlarged, to show the strongly elevated nodes on the celluliferous face, the oblique nodes on the non-celluliferous face, and the oblique dissepiments. (× 6.)

Fig. 28. A lateral view of a branch, showing regular nodes and dissepiments of a greater height than those of the two preceding specimens.

Fig. 29. An enlargement of a portion of the celluliferous face of a frond, showing the form and arrangement of the cell apertures, and the nodose elevation along the middle of the branch.

Fig. 30. An enlargement of a portion of the celluliferous face of a frond, showing the cell apertures filled with mineral matter, and a channel along the middle of the branches and sometimes along the dissepiments. This is the most frequent condition of this species. (× 6.)

Fig. 31. An enlargement of the top of a node or elevation; a. is the end of a narrow node. (× 16.)

Fig. 31a. The stellate summit of a node like fig. 32b.

Fig. 31b. An enlargement, giving a lateral view of the upper part of a simple node. (× 16.)

Fig. 32. *a*. An enlargement of the top of an elevation, and *b*. the side of the same elevation or node, all gradations of elevations or nodes between fig. 31*b*. and 32*b*. occur. (× 16.)

Fig. 32a. The summit of a more simple form of node than 32b.

Fig. 32b. An enlargement, giving lateral view of a more elevated form of node with plicated upper margins and stelliform summit. (× 16.)

Fig. 33. A fragment of a frond, natural size, showing the comparative size of the branches and the mode of growth.

Fig. 34. A fragment, natural size.

Fig. 35. An enlargement of the non-celluliferous face of a frond. (× 6.)

Fig. 36. An enlargement of the celluliferous face of a frond. (× 6). Figures 34, 35 and 36 are doubtfully referred to this species.

Upper Helderberg group. *Falls of the Ohio river.*

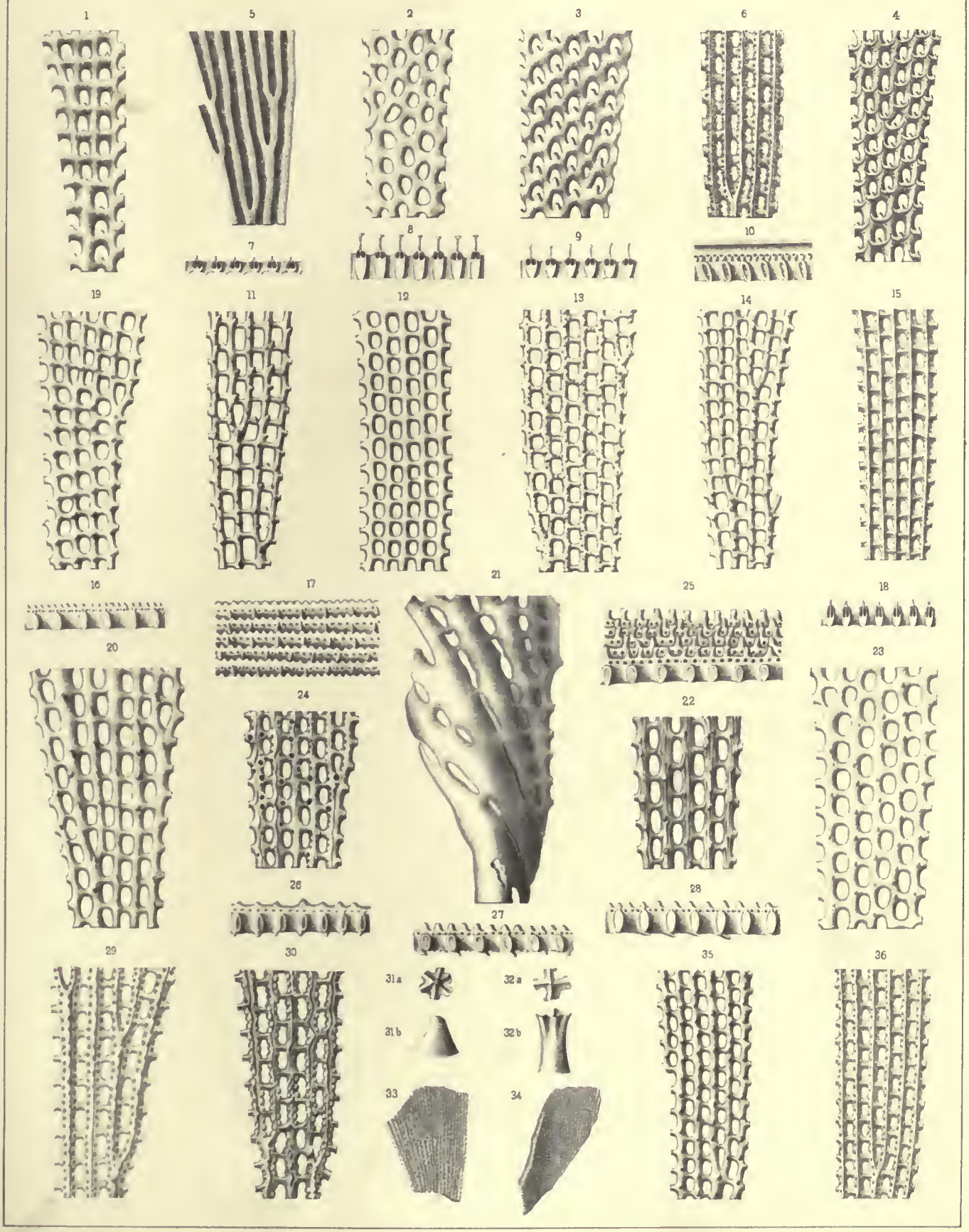
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PLATE XLVIII.

Fenestella latijunctura.

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Fig. 1. An enlargement of a portion of the non-celluliferous face of a frond, showing very irregular branches, with frequent elevations around the lower portion of the fenestrules and numerous strong nodes. (× 6.)

Fig. 2. A portion of the non-celluliferous face of a frond. The branches present a very irregular appearance, and many of the strong nodes are prolonged into spines. (× 6.)

Fig. 3. A portion of the celluliferous face of a frond with the carinæ removed, showing the form and arrangement of the cell apertures. The branches are remarkably regular as compared with the opposite face. The lithographic figure fails to represent the original drawing. (× 6.)

Fig. 4. A lateral view of a branch, showing a transverse section of the dissepiments, the cell apertures opening directly outward, and the strongly elevated carina, with its lateral denticulations.

Fig. 5. A transverse section of the branches and carinæ.

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella bi-imbricata.

Page 121.

Fig. 6. An enlargement of the non-celluliferous face of a frond, presenting a very irregular appearance, making it difficult to distinguish the branches and dissepiments. The surface of the frond also has been somewhat affected by maceration. (× 6.)

Fig. 7. A portion of the non-celluliferous face of a frond, in which the branches and dissepiments cannot be distinguished from each other, the face of the frond presenting very much the appearance of some encrusting zoarium. (× 6.)

Fig. 8. An enlargement of a portion of the non-celluliferous face of a frond, showing the branches and dissepiments so thickened and involved as to have lost their distinctive character. (× 6.)

Fig. 9. An enlargement from the celluliferous face of a frond. The branch at the left of the figure shows the expanded summit of the carina. The two adjacent branches show the interior; the next branch shows the surface nearly worn through, and the two branches at the right preserve their normal condition. (× 6.)

Fig. 10. An enlargement of the summits of the carinæ on the celluliferous face. (× 6.)

Fig. 11. A transverse section of the branches and carinæ. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella interrupta.

Page 123.

Fig. 12. An enlargement of a portion of the non-celluliferous face of a frond which has been worn and macerated. (× 6.)

Fig. 13. A transverse section of the branches and carinæ. (× 6.)

Fig. 14. An enlargement of a portion of the non-celluliferous face of a frond, somewhat macerated. The branches and dissepiments are essentially undistinguishable from each other and are frequently disposed in a stellate manner. (× 6.)

Fig. 15. An enlargement from the non-celluliferous face of a frond, showing angular and carinated branches and dissepiments of nearly equal width, which are so irregularly disposed that they cannot readily be distinguished from each other. (× 6.)

Fig. 16. A portion of the non-celluliferous face of a frond, showing the branches and dissepiments of nearly equal width, but so irregularly disposed as not to be readily distinguished from each other. (× 6.)

Fig. 17. An enlargement of a portion of the celluliferous face of a frond of this species. On the left of the figure the carinæ are broken away, showing the form and arrangement of the cell apertures. On the right of the figure the summits of the carinæ are shown. (× 6.) (The lithographic figure has failed to give the proper effect.)

Upper Helderberg group. *Falls of the Ohio river.*

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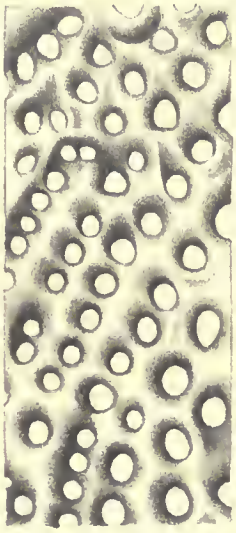
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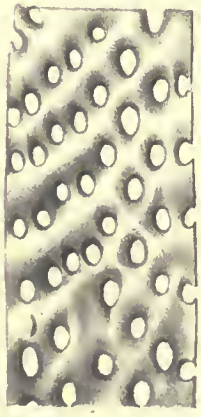
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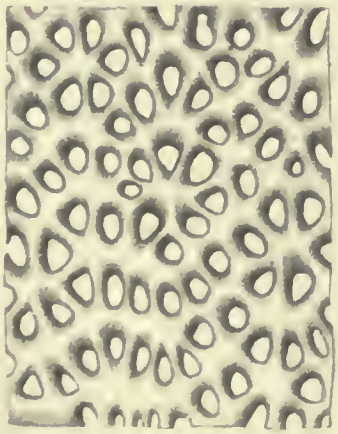
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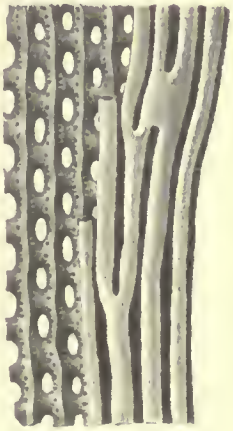
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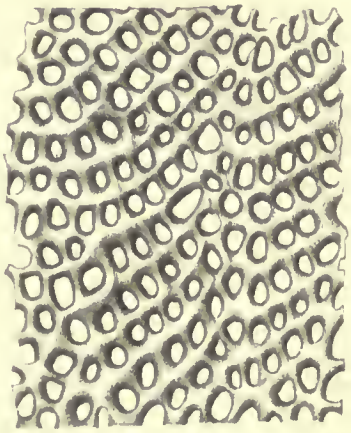
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PLATE XLIX.

Fenestella permarginata.

Page 127.

Figs. 1, 2, 3. Enlargements from the non-celluliferous face, showing the obscure characters of the branches and dissepiments.

Fig. 4. The celluliferous face, with the carinæ removed, showing the arrangement of the cell apertures.

Fig. 5. A portion of the celluliferous face of a frond. The lower half of the figure shows the carinæ united and with some vesiculose tissue in the lower part.

Fig. 6. An enlargement from the non-celluliferous face, showing numerous nodes ornamenting the branches and dissepiments.

Fig. 7. The base of a frond, natural size.

Fig. 8. A lateral view of a portion of a branch, enlarged.

Fig. 9. A transverse section, showing the form of the branches and carinæ.

Fig. 10. A section similar to the preceding, in which the branches are larger and the fenestrules narrower.

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella semirotunda.

Page 125.

Fig. 11. The base and lower portion of a frond, natural size.

Fig. 12. The celluliferous face of a fragment, natural size.

Fig. 13. A transverse section of several branches, showing the elevation and expansion of the carinæ.

Fig. 14. A transverse section of branches more cylindrical than the preceding.

Fig. 15. An enlargement of the summits of the carinæ from the lower portion of the frond where they are connected by vesiculose tissue.

Fig. 16. An enlargement from the non-celluliferous face, showing the involved and irregular branches and dissepiments.

Fig. 17. The non-celluliferous face of a specimen with more regular fenestrules.

Fig. 18. An enlargement similar to the preceding, but with stronger branches and dissepiments, and smaller fenestrules.

Fig. 19. The non-celluliferous side of a fragment, showing characters similar to fig. 16.

Fig. 20. The non-celluliferous face of a specimen preserving irregularly distributed nodes on the branches and dissepiments.

Fig. 21. The celluliferous face with the carinæ removed, showing the cell apertures.

Fig. 22. The celluliferous face of a specimen showing the summits of the carinæ and their irregular lateral expansions.

Upper Helderberg group. *Falls of the Ohio river.*

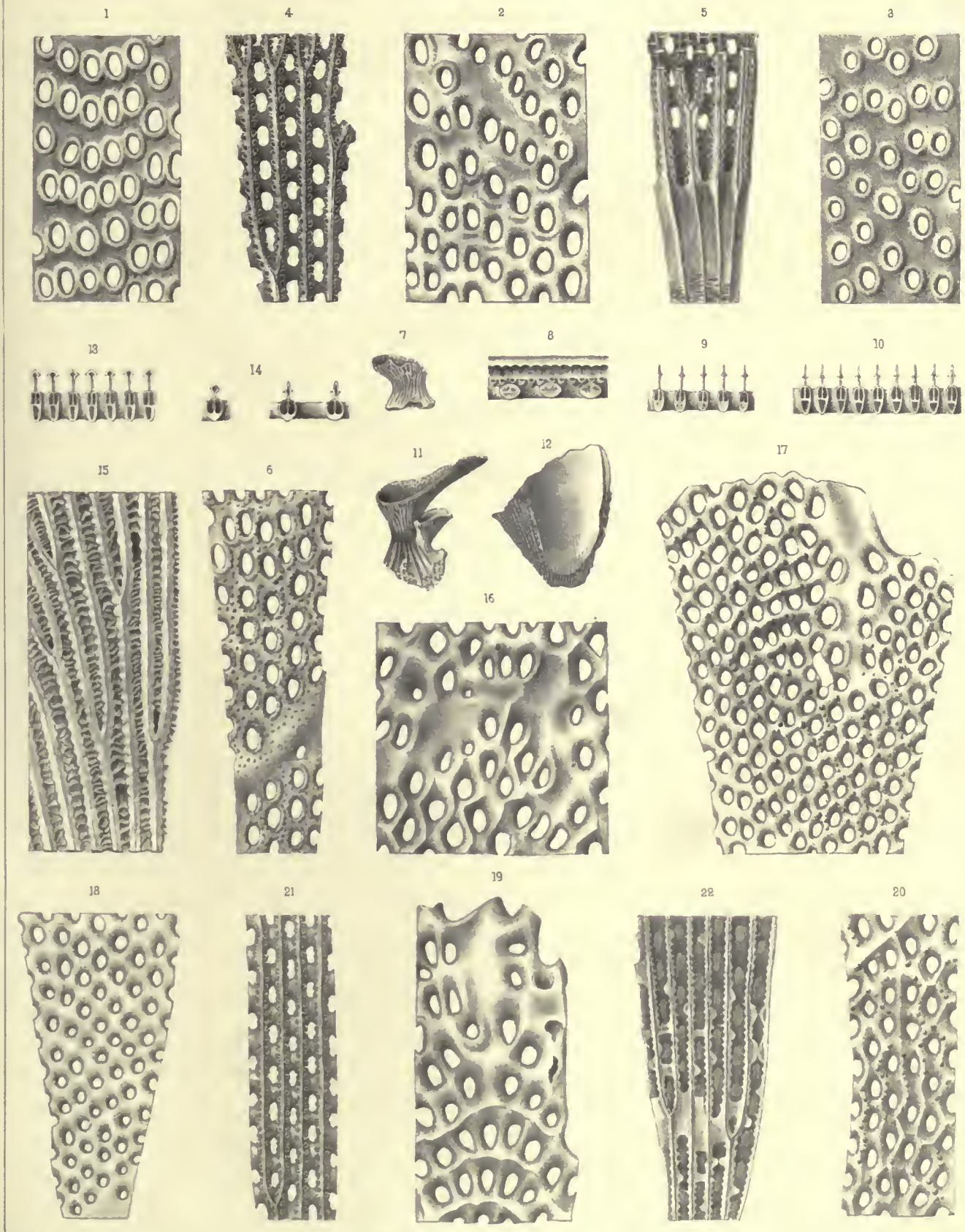
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PLATE L.

FENESTELLA CULTRATA.

Page 120.

Fig. 1. A fragment, natural size, showing the manner of growth.

Fig. 2. A transverse section of the branches. (× 6.)

Fig. 3. A lateral view of a branch, showing a transverse section of the dissepiments, and the irregular arrangement of the cell apertures.

Fig. 4. A portion of the non-celluliferous face of a frond. (× 6.)

Fig. 5. A portion of the celluliferous face. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

FENESTELLA BISERRULATA.

Page 128.

Fig. 6. A fragment natural size, showing the manner of growth.

Fig. 7. A transverse section, showing the form of the branches and carinæ and the space occupied by the cells. (× 6.)

Fig. 8. A lateral view of a branch, showing a transvere section of the dissepiments, the cell apertures, the crenulations in the margin of the carina, immediately above and corresponding in number to the cell apertures. The projections on the side of the carina have somewhat the appearance of a range of minute cells, but the lithographic figure does not properly represent the original drawing. (× 6.)

Fig. 9. A portion of the non-celluliferous face of a frond, showing the comparative size and character of the branches and dissepiments. (× 6.)

Fig. 10. A portion of the celluliferous face, showing the cell apertures and also the expanded summits of the carinæ with their lateral crenulations. The lithographic figure has failed to preserve the effect of the original drawing; the same criticism will apply to fig. 11.

Fig. 11. An enlargement of a portion of the celluliferous face, having the carinæ broken away, leaving the branch grooved along its center, showing the form and arrangement of the cell apertures, and their elevated margins slightly indenting the borders of the fenestrules. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

FENESTELLA GRANIFERA.

Page 125.

Fig. 12. An enlargement of a portion of the non-celluliferous face, showing angular sinuous branches with dissepiments much wider than the branches. (× 6.)

Fig. 13. An enlargement of a portion of the non-celluliferous face, showing flattened branches and dissepiments, with a row of minute granules along the middle of the branch. The flattened branches and dissepiments would indicate that the specimen has been worn or macerated, but in that case it seems hardly possible that the granules should be so well preserved.

Fig. 14. An enlargement of the celluliferous face of a portion of the frond from near the base, covered by an organic deposit, which forms a solid crust over that portion of the specimen.

Fig. 16. A portion of the non-celluliferous face enlarged to six diameters; the left side of the figure shows two branches in the same conditions as those of fig. 13; the two adjacent branches are apparently worn so that the cells are partially exposed; the right of the figure shows the branches broken away so that the under sides of the expanded crenulate carinæ are exposed.

Upper Helderberg group. *Near Le Roy, N. Y.*

PLATE I.—Continued.

FENESTELLA ERECTIPORA.

Page 118.

Fig. 15. A portion of the non-celluliferous face enlarged, showing the appearance and comparative size of the branches and dissepiments. (× 6.)

Fig. 17. A portion of the celluliferous face of the frond with the carinæ broken away, showing the form and arrangement of the cell apertures. (× 6.)

Upper Helderberg group. *Ontario, Canada.*

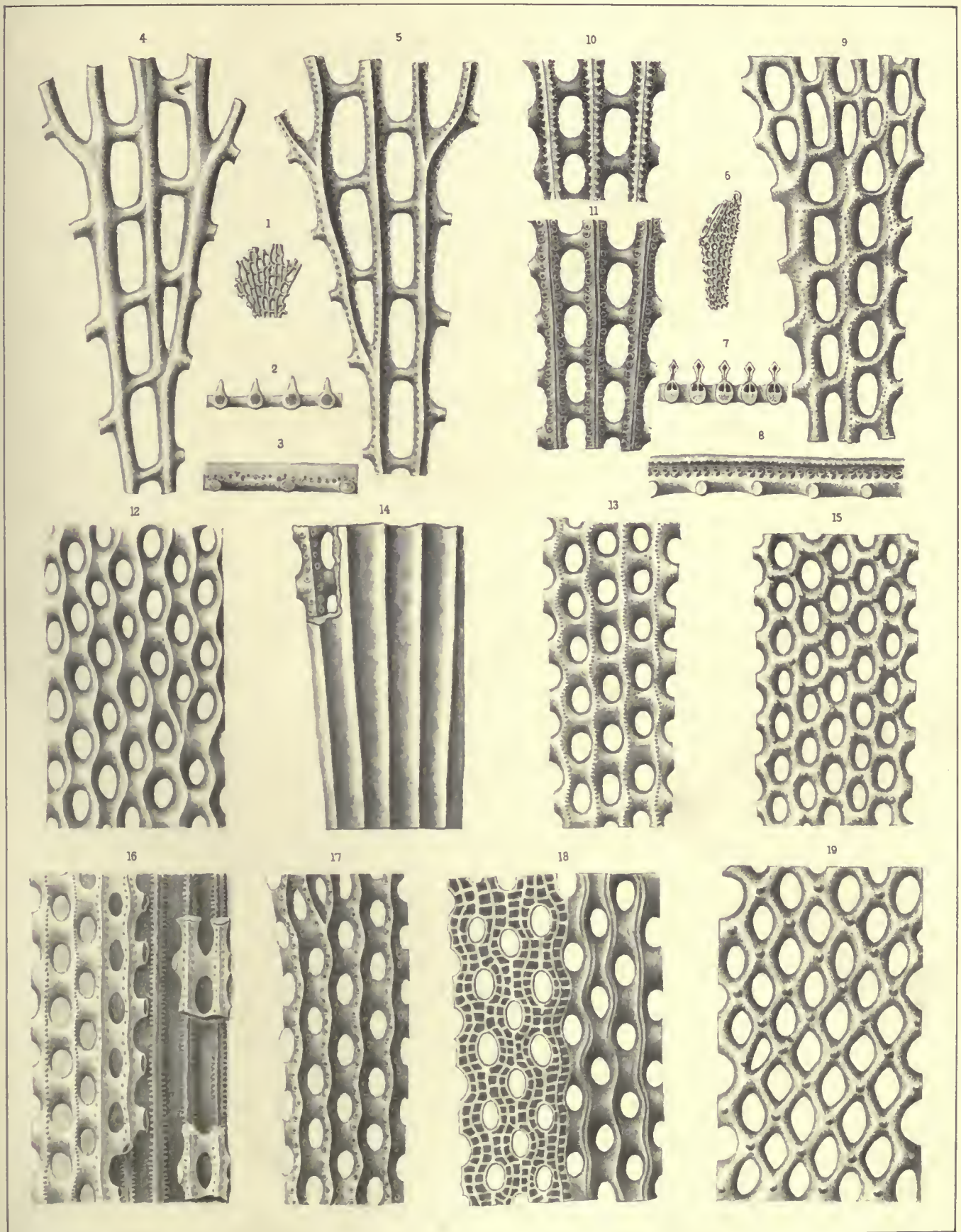
FENESTELLA (RETEPORINA) RHOMBIFERA.

Page 119.

Fig. 18. A portion of the non-celluliferous face of a frond which is much worn or macerated. The four branches on the left of the figure are so much worn that the bases of the cells are exposed to view; the remaining branches are less worn, but the surface characters are obsolete. (× 6.)

Fig. 19. A portion of the non-celluliferous face of another frond, showing the branches well preserved and anastomosing, with a prominent node at the center of each junction. The celluliferous face in a perfect condition has not been observed, so that it is impossible to say with certainty to what subgenus it belongs, but probably to *Reteporina*. (× 6.)

Upper Helderberg group. *Le Roy, Genesee county, N. Y.*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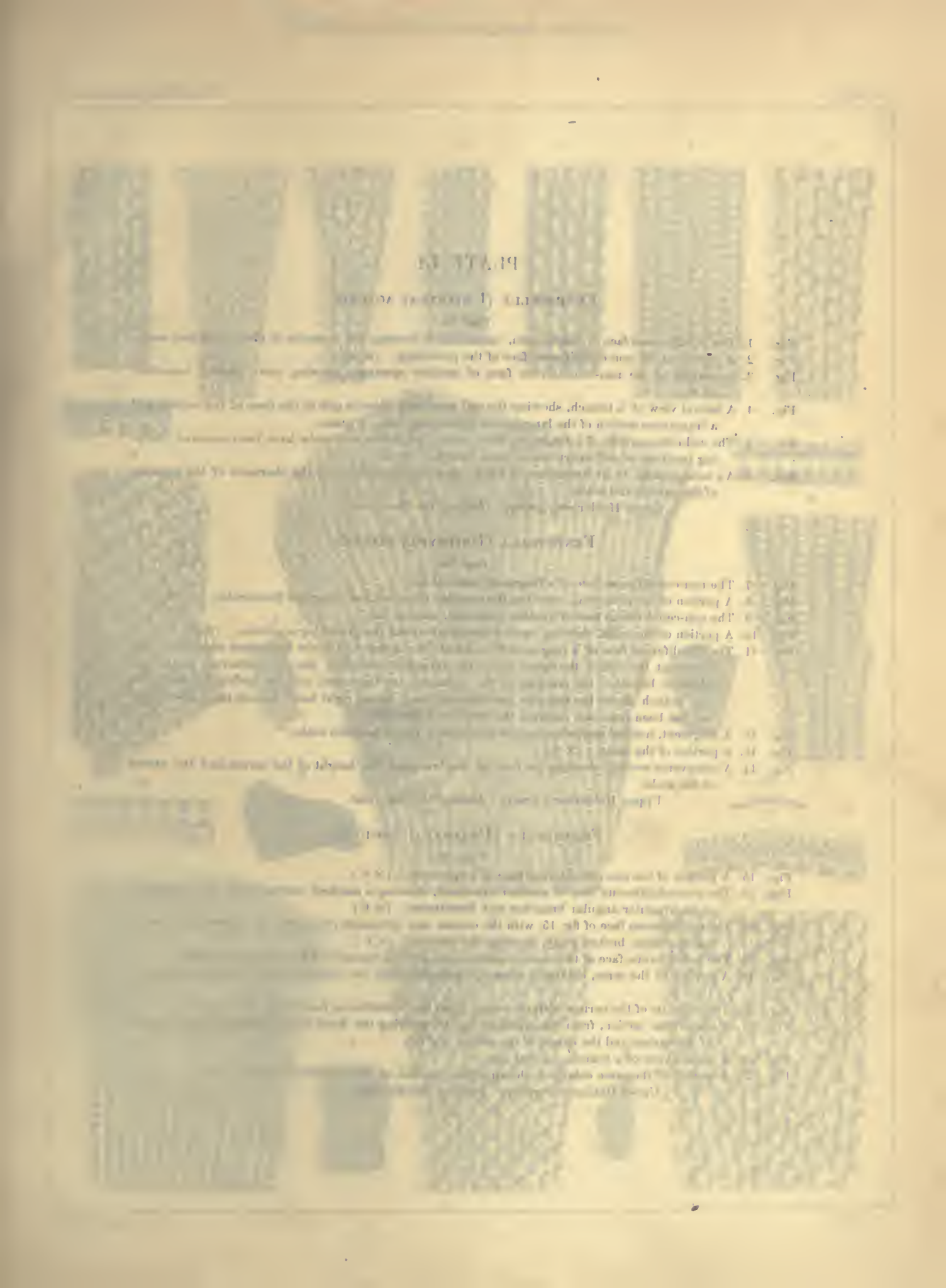

PLATE LI.

Fenestella (Unitrypa) acaulis.

Page 131.

Fig. 1. The celluliferous face of a specimen, natural size, showing the summits of the carinæ and scalæ.
Fig. 2. A portion of the non-celluliferous face of the preceding. (× 6.)
Fig. 3. A portion of the non-celluliferous face of another specimen, showing more slender branches. (× 6.)
Fig. 4. A lateral view of a branch, showing the cell apertures, minute pits in the base of the carina, and a transverse section of the lamelliform connecting bars, or scalæ.
Fig. 5. The celluliferous side of a fragment, from which the carinæ and scalæ have been removed, showing two rows of cell apertures on each branch. (× 6.)
Fig. 6. An enlargement, to six diameters, of fig. 1, showing more distinctly the character of the summits of the carinæ and scalæ.

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Unitrypa) stipata.

Page 134.

Fig. 7. The non-celluliferous face of a fragment, natural size.
Fig. 8. A portion of the preceding, showing the angular branches and irregular fenestrules. (× 6.)
Fig. 9. The non-celluliferous face of another fragment, natural size.
Fig. 10. A portion of the same, showing smaller fenestrules than the preceding specimen. (× 6.)
Fig. 11. The celluliferous face of a fragment from which the carinæ and scalæ have been removed. The branch at the left of the figure shows the natural condition of the cell apertures; on the two adjacent branches the margins of the apertures are thickened and the openings closed; the next branch shows the margins broken away, and in the right hand branch the entire upper test has been removed, showing the interior of the cells.
Fig. 12. A fragment, natural size, showing the summits of the carinæ and scalæ.
Fig. 13. A portion of the same. (× 6.)
Fig. 14. A transverse section, showing the form of the branches, the height of the carinæ and the extent of the scalæ.

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Unitrypa) tegulata.

Page 135.

Fig. 15. A portion of the non-celluliferous face of a specimen. (× 6.)
Fig. 16. The non-celluliferous face of another specimen, showing a marked contrast with the preceding, in its irregular angular branches and fenestrules. (× 6.)
Fig. 17. The celluliferous face of fig. 15, with the carinæ and processes removed; the right-hand branch has the tissue broken away, showing the interior. (× 6.)
Fig. 18. The celluliferous face of the same, natural size, showing summits of the carinæ and scalæ.
Fig. 19. A portion of the same, enlarged, showing more distinctly the characters of the specimen, fig. 18. (× 6.)
Fig. 20. The summits of the carinæ with the scalæ, from the celluliferous face of fig. 16. (× 6.)
Fig. 21. A transverse section, from the specimen fig. 15, showing the form of the branches, the elevation of the carinæ and the extent of the scalæ. (× 6.)
Fig. 22. A lateral view of a branch, natural size.
Fig. 23. A portion of the same enlarged, showing the direction of the lamelliform scalæ. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

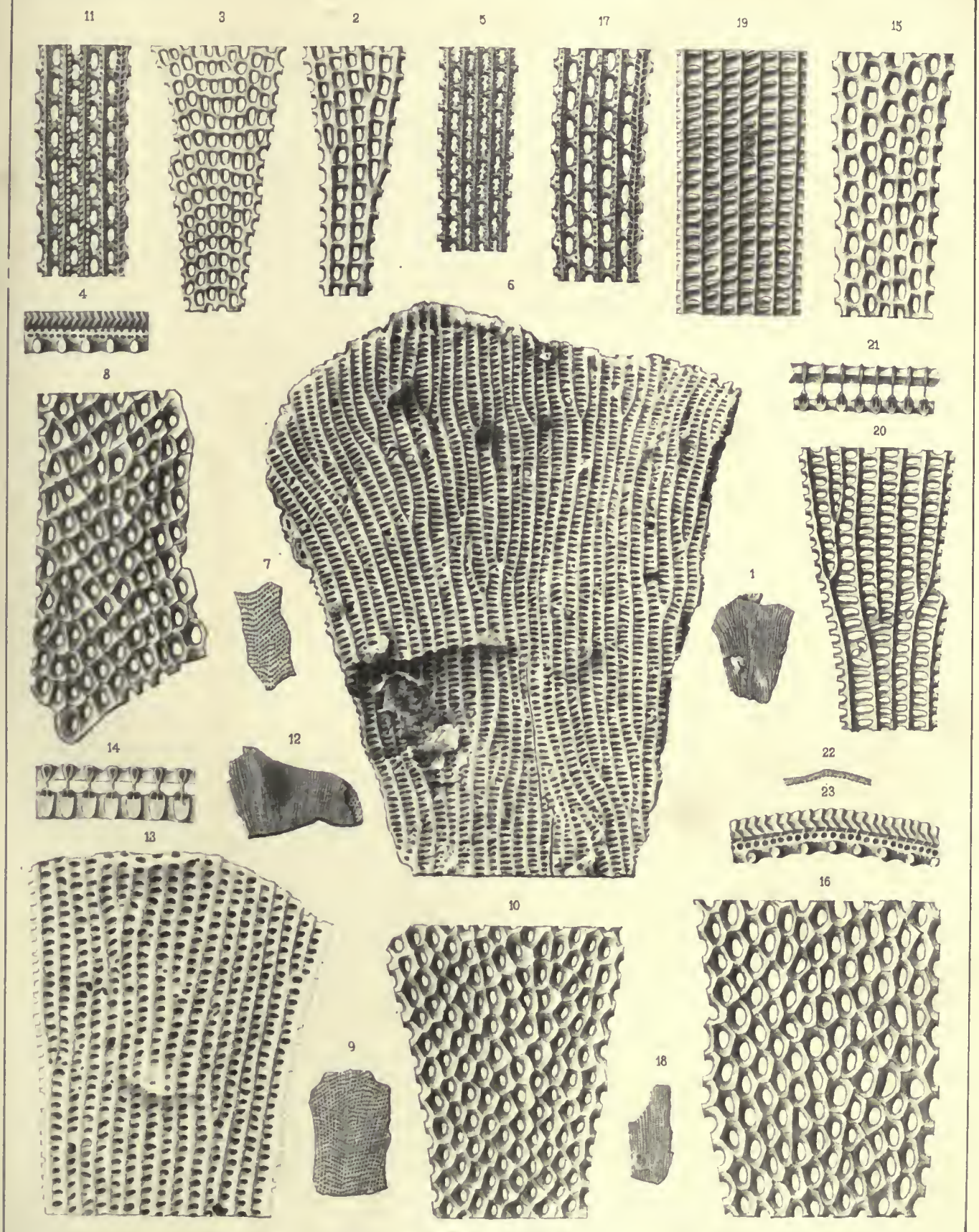
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PLATE LII.

Fenestella (Unitrypa) lata.

Page 136.

Fig. 1. An enlargement of a portion of the non-celluliferous face of a frond, showing very regular branches and angular carinate dissepiments. (× 6.)

Fig. 2. An enlargement having a somewhat more robust appearance than the preceding. (× 6.)

Fig. 3. An enlargement; the branches and dissepiments are partially imbedded in a sediment and presents a much more slender appearance than would be the case if the whole surface could be observed. Without a careful examination, this would seem to be the full size of the branches and dissepiments (× 6.)

Fig. 4. An enlargement, representing an impression in the rock; the left of the illustration represents the impression left by the carinæ and connecting scalæ, the right the impression of the cell bases. The tissue has been partially destroyed by maceration; the solid portion left is the filling in of the cells and of the spaces between the scalæ; the solid oval spaces are the filling of the fenestrules. (× 6.)

Fig. 5. An enlargement of a portion of the celluliferous face of a frond, showing the form and arrangement of the cell apertures, the carinæ having been broken away. (× 6.)

Fig. 6. An enlargement of the summits of the carinæ and the scalæ connecting them.

Fig. 7. An enlargement; the upper left corner represents the non-celluliferous face of the branches; the remainder of the illustration represents the bases of the carinæ, that is, the portion joining the celluliferous face of the branches and the under side of the scalæ connecting the carinæ. The entire substance of the cell-bearing portion of the branch has been removed from this portion of the specimen. (× 6.)

Fig. 8. An enlargement; the upper portion of the figure representing the interior of the branches and the exterior with cell apertures; the lower and left hand portion, the summits of the carinæ, and the scalæ connecting the carinæ. (× 6.)

Fig. 9. A lateral view of a branch enlarged, showing a transverse section of the dissepiments, and the scalæ connecting the carinæ, which are abruptly bent at a point a little above the middle of their depth. (× 6.)

Fig. 10. A fragment, natural size, comprising a portion of the base of a frond.

Fenestella (Unitrypa) ficticius.

Page 137.

Fig. 11. An enlargement; the lower portion represents the non-celluliferous face of the branches; the upper portion the base of the carinæ and the under side of the scalæ. (× 6.)

Fig. 12. An enlargement of a portion of the non-celluliferous face of a frond. (× 6.)

Fig. 13. An enlargement of the summits of the carinæ and the oblique scalæ. (× 6.)

Fig. 14. An enlargement of a portion of the celluliferous face of a frond, having the carinæ and scalæ removed, showing the form and arrangement of the cell apertures. (× 6.)

Fig. 15. An enlargement of the base of the carinæ and the under side of the connecting scalæ, similar to the upper portion of fig. 11. This illustration is given to show how easily it might, by itself, be mistaken for the celluliferous face of some form of Fenestella. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

PLATE LII—Continued.

Fenestella (Unitrypa) acclivis.

Page 138.

Fig. 16. An enlargement of a portion of the non-celluliferous side of a frond, showing for the most part a ridge of prominent nodes along the middle of the branch; the dissepiments are also nodose. (× 6.)

Fig. 17. An enlargement of a portion of the non-celluliferous face of a frond, the branches having two rows of nodes, and the dissepiments being without nodes. (× 6.)

Fig. 18. An enlargement of the celluliferous face, the carinæ broken away, showing the form and arrangement of the cell apertures. (× 6.)

Fig. 19. An enlargement; the lower left hand corner represents a bifurcating branch; the remainder of the figure represents the curved processes connecting the carinæ. These are for the most part so prominent as to obliterate the summits of the carinæ, and might be very easily mistaken for some form of encrusting Bryozoa. (× 6.)

Fig. 20. An enlargement of the mold in the rock of a portion of the non-celluliferous face of a frond. (× 6.)

Fig. 21. An enlargement of the mold left in the rock by the dissolving away of a frond; the left portion of the figure represents the filling of the cells and fenestrules; the right, the filling of the spaces between the processes connecting the carinæ. These fillings, which are a deposit of siliceous sediment, have in some cases been mistaken for organic structure. (× 6.)

Fig. 22. An enlargement of the mold of the side of a branch, when the cell apertures and interstices between the scalæ have been filled with siliceous matter. (× 6.)

Fig. 23. A tranverse section of the branches and carinæ enlarged, showing the depth of the scalæ connecting the carinæ. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

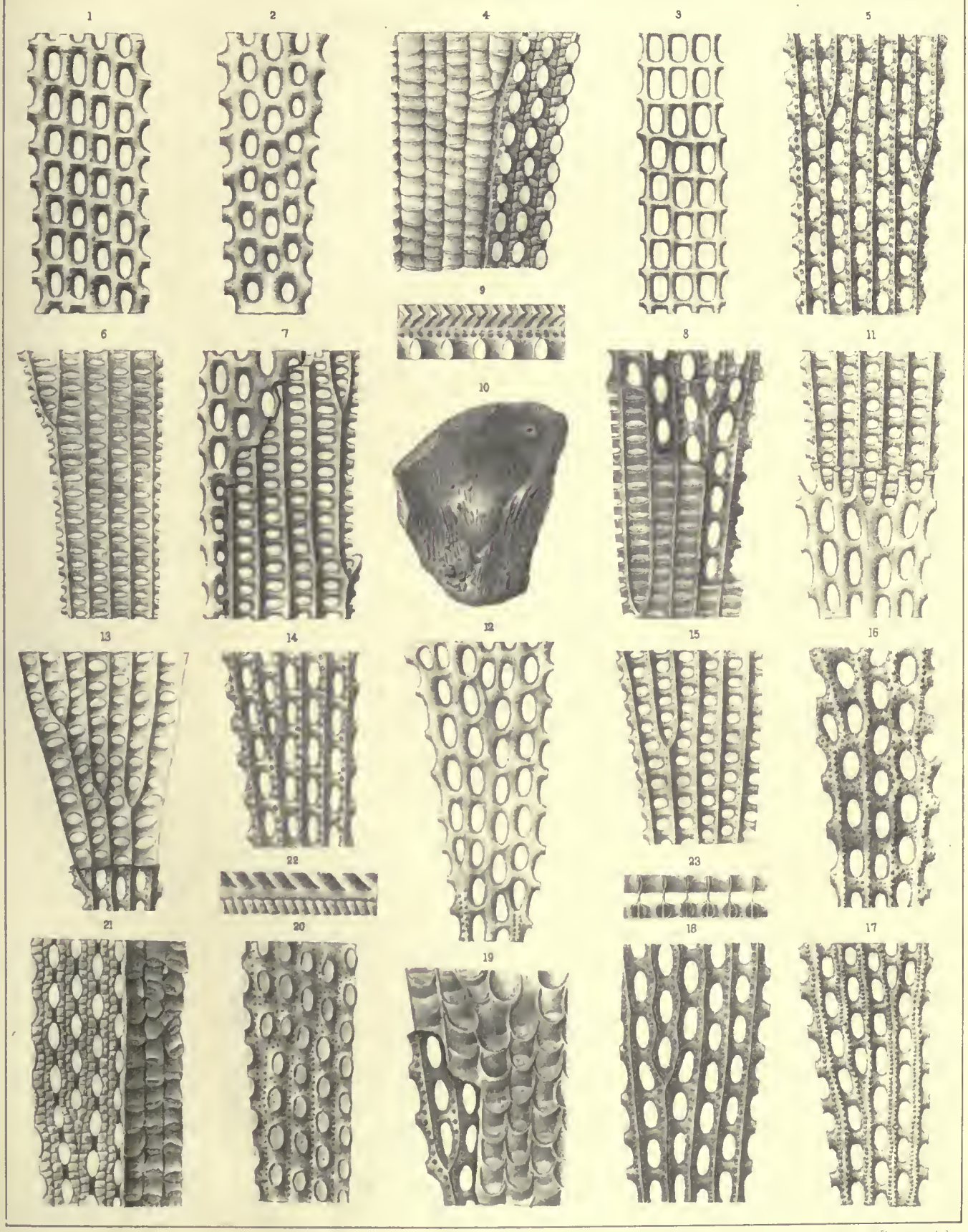
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PLATE LIII.

Fenestella (Unitrypa) pernodosa.

Page 139.

Fig. 1. A portion of the non-celluliferous face of a frond, natural size.
Fig. 2. A portion of another specimen enlarged, showing the irregular nodes. (× 6.)
Fig. 3. A similar specimen, with stronger nodes. (× 6.)
Fig. 4. A specimen, which has been macerated, showing the striated structure of the branch, beneath the surface, on the non-celluliferous side. (× 6.)
Fig. 5. An oblique view of two branches of fig. 2, showing the form and arrangement of the nodes. (× 6.)
Fig. 6. The celluliferous face of a fragment from which the carinæ and scalæ have been removed, showing the sinuous form of the branches on this face. (× 6.)
Fig. 7. The summits of the carinæ with the oblique subtubular openings to the interior of the frond, formed by the oblique transverse scalæ. (× 6.)
Fig. 8. A similar view, showing a more irregular arrangement, in which the summits of the carinæ are not continuous in right lines. (× 6.)
Fig. 9. A view of a specimen similar to fig. 7, in which the carinæ, scalæ and outer portion of the celluliferous test have been removed from the lower half, as shown in the figure, exposing the interior of the branches. (× 6.)
Fig. 10. The reverse of the preceding, as shown in a natural mould in the rock. (× 6.)
Fig. 11. The celluliferous face of a specimen, showing the structure of the frond; the lower part of the figure shows the celluliferous face with two rows of cell apertures on each branch; above this the figure represents the specimen with the celluliferous crust removed, exposing the interior of the branches; the central portion shows the filling of extraneous matter occupying the oblique tubes formed by the carinæ and scalæ which have been removed by solution; in the upper right-hand portion of the figure, the summits of the carinæ and scalæ are represented. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

Fenestella (Unitrypa) elegantissima.

Page 140.

Fig. 12. The non-celluliferous face of a fragment, natural size.
Fig. 13. An enlargement from the preceding, showing the single row of small nodes on each branch. (× 6.)
Fig. 14. The non-celluliferous face of a specimen imbedded in the rock; the branches have been removed from the lower left-hand portion, exposing the bases of the carinæ and the under side of the scalæ. (× 6.)
Fig. 15. An oblique view of two branches, showing the elevation of the nodes. (× 6.)
Fig. 16. The celluliferous face of the branches with the carinæ and scalæ removed. (× 6.)
Fig. 17. The celluliferous aspect of a fragment. The principal part of the figure shows the summits of the carinæ and the scalæ, leaving tubular openings into the interior. On the upper portion of the figure the carinæ are removed, exposing the celluliferous face of the branches. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

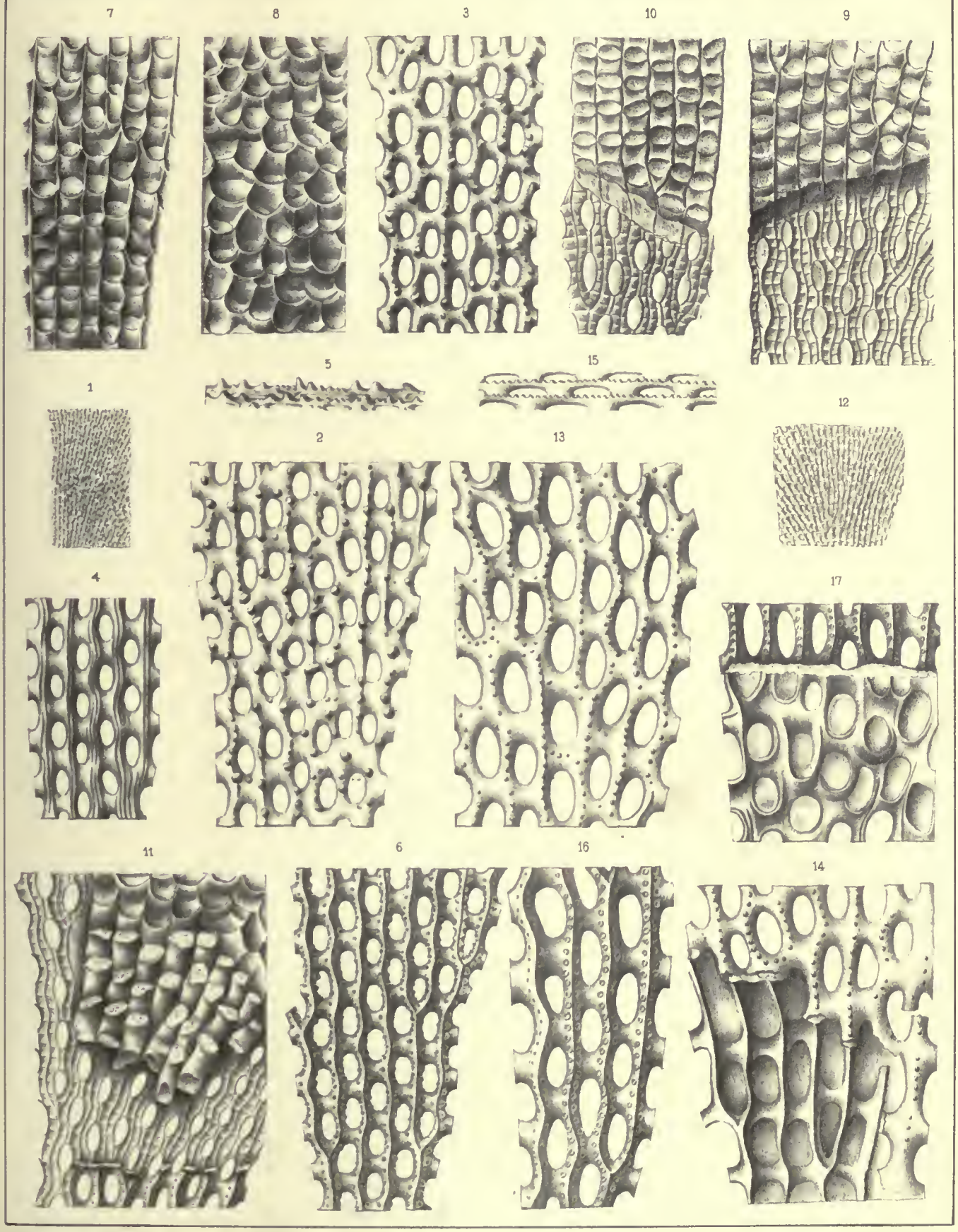
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PLATE LIV.

Fenestella (Unitrypa) fastigata.

Page 141.

Fig. 1. A fragment, natural size, showing the carina and connecting processes.
Fig. 2. The same fragment, natural size, showing the non-celluliferous side.
Fig. 3. A lateral view of a branch enlarged, showing a transverse section of the dissepiments and connecting processes or scalæ. (× 6.)
Fig. 4. A transverse section of the branches, also showing the depth of the connecting scalæ. (× 6.)
Fig. 5. An enlargement of a portion of the non-celluliferous face of a frond. (× 6.)
Fig. 6. An enlargement of the summits of the carinæ and the connecting scalæ. (× 6.)

Upper Helderberg group. *Falls of the Ohio river.*

Fenestella (Unitrypa ?) consimilis.

Page 142.

Fig. 7. An enlargement of the summits of the carinæ and connecting scalæ. This form might very readily be mistaken for the non-celluliferous face of other Fenestelloid forms. (× 6.)
Fig. 8. An enlargement of the celluliferous face of a frond; the carina is broken away, showing the form and arrangement of the cell apertures. (× 6.)
Fig. 9. An enlargement; the two branches on the right have the surface broken away, showing the interior; the next two branches have the carina broken away and show the form and arrangement of the cell apertures; the left of the figure shows the summits of two carinæ and their connecting scalæ. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

Fenestella (Isotrypa) conjunctiva.

Page 143.

Fig. 10. An enlargement of a portion of the non-celluliferous side of a frond, showing somewhat flattened branches, with a row of nodes along the middle, and a poriform opening on nearly all the dissepiments. (× 6.)
Fig. 11. An enlargement, showing rounded branches without nodes and with very conspicuous openings in the dissepiments.
Fig. 12. An enlargement, showing the angular and carinated branches and dissepiments, with a few openings in the latter, and these on the lower portion; in this respect differing from every other specimen. (× 6.)
Fig. 13. An enlargement, showing a mold, in the rock, of the celluliferous face, and the summits of the carinæ. (× 6.)
Fig. 14. An enlargement of the summit of the carina and connecting scalæ. (× 6.)
Fig. 15. An enlargement of the celluliferous face, the carinæ having been broken away, showing the form and arrangement of the cell apertures. (× 6.)
Fig. 16. A lateral view of the upper half of a branch. (× 6.)
Fig. 17. A fragment of a frond, natural size, showing the summits of the carinæ and connecting scalæ.
Fig. 18. A fragment of the non-celluliferous face of a frond, natural size, showing the size of the branches and mode of growth.
Fig. 19. An enlargement, showing angular, carinated branches, which are straighter than those represented in fig. 12; the poriform openings are on the upper side of the dissepiments. (× 6.)
Fig. 20. An enlargement, showing the under sides of the summits of the carinæ and their connecting scalæ. (× 6.)
Fig. 21. An enlargement of the specimen illustrated by fig. 11, to show more plainly the striations on the branches and the character of the openings on the dissepiments. (× 18.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

PLATE LIV—Continued.

Fenestella (Loculipora) circumstata.

Page 144.

Fig. 22. An enlargement of the celluliferous face; the carinæ, having been broken away, showing the form and arrangement of the cell apertures.

Fig. 23. An enlargement; the lower portion of the figure represents the non-celluliferous face; the upper right hand portion represents a specimen with the non-celluliferous face broken away, showing the base of the reverse side. (× 6.)

Fig. 24. An enlargement, showing reverse side, corresponding to the summits of the carinæ and connecting scalæ of Hemitrypa; the lower right hand corner represents this tissue broken away, showing the celluliferous face of the frond. (× 6.)

Fig. 25. An enlargement of the non-celluliferous face of a frond similar to the preceding. (× 6.)

Upper Helderberg group. *Walpole, Ontario, Canada.*

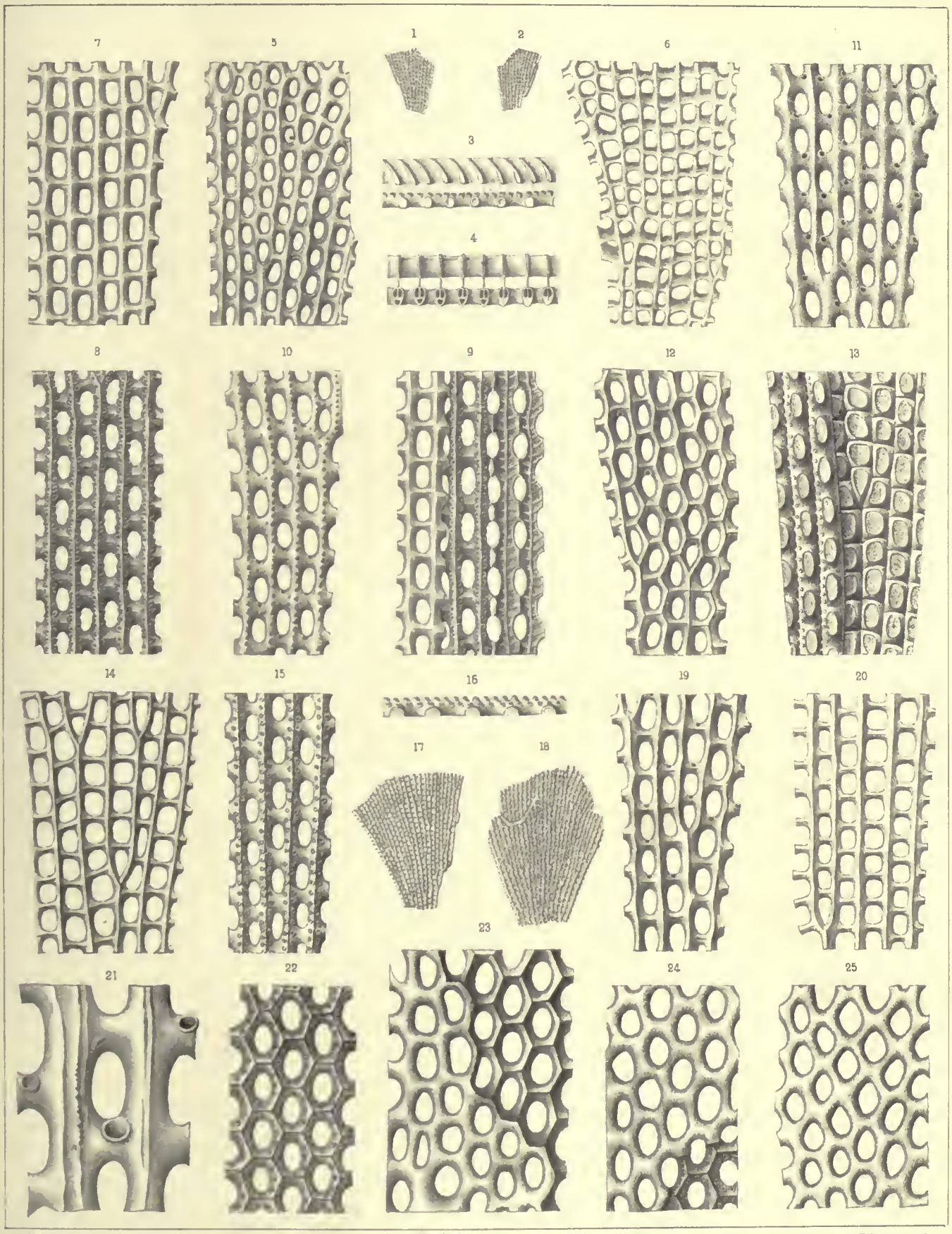
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PLATE LV.

TREMATOPORA (ORTHOPORA) ORNATA.

Page 184.

See Plate 56.

Fig. 1. An enlargement, showing the form and disposition of the cell apertures and the character of the interapertural space. (× 6.)
Hamilton group. *Geneseo, N. Y.*

TREMATOPORA (ORTHOPORA) CARINATA.

Page 179.

See Plate 56.

Fig. 2. An enlargement, showing the form and disposition of the cell apertures, the nodes between them, and the prominent ridges separating the ranges of apertures. (× 6.)
Hamilton group. *West Williams, Ontario, Canada.*

TREMATOPORA (ORTHOPORA) LINEATA.

Page 181.

See Plate 56.

Fig. 3. An enlargement of a portion of a well-preserved frond, showing the form and arrangement of the cell apertures, and the granulose ridges separating the ranges of apertures. (× 6.)
Fig. 4. An enlargement, showing the appearance of a frond when macerated. (× 6.)
Fig. 5. An enlargement of a longitudinal section, showing the manner of growth of the cell tubes, and the intercellular space. (× 6.)
Hamilton group *West Hamburg, Erie county, N. Y.*
Fig. 6. An enlargement of a portion of a sinuous frond having a greater number of ranges of apertures than fig. 3. (× 6.)
Hamilton group. *Ogdens Ferry, Cayuga lake, N. Y.*

ACANTHOCLEMA SULCATUM.

Page 192.

See Plate 56.

Fig. 7. An enlargement, showing the form and disposition of the cell apertures, and the sharply angular, smooth ridges separating the ranges of apertures.
Hamilton group. *Darien Centre, Genesee county, N. Y.*

TREMATOPORA (ORTHOPORA) HEXAGONA.

Page 178.

See Plate 56.

Fig. 8. An enlargement, showing the form and disposition of the cell apertures, and the appearance of the interapertural space. (× 6.)
Hamilton group. *Eighteen-mile-creek, Erie county, N. Y.*

TREMATOPORA (ORTHOPORA) RETICULATA.

Page 179.

See Plate 56.

Fig. 9. An enlargement, showing the form and arrangement of the cell apertures, and the granulose and nodose interapertural space. (× 6.)
Hamilton group. *Western New York.*

TREMATOPORA (ORTHOPORA) SUBQUADRATA.

Page 177.

See Plate 56.

Fig. 10. An enlargment, showing the form and disposition of the cell apertures, and the polygonal areas. (× 6.)
Hamilton group. *Darien Centre, Genesee county, N. Y.*

TREMATOPORA (ORTHOPORA) ELONGATA.

Page 183.

See Plate 56.

Fig. 11. An enlargement of a longitudinal section, showing the manner of growth of the cell tubes, and the intercellular space. (× 6.)
Hamilton group. *Owasco Lake, N. Y.*

PLATE LV—Continued.

TREMATOPORA (ORTHOPORA?) TRANSVERSA.

Page 187.

See Plate 56.

Fig. 12. An enlargement of a longitudinal section, showing the manner of growth of the cell tubes, and the interapertural space. (× 6.)
Hamilton group. *Hamburg, Lake Erie shore, Erie county, N. Y.*

TREMATOPORA (ORTHOPORA?) ORBIPORA.

Page 188.

See Plate 56.

Fig. 13. An enlargement, showing the form and disposition of the cell apertures, and the character of the interapertural space. (× 6.)
Fig. 14. An enlargement of a longitudinal section, showing the manner of growth of the cell tubes, and the intercellular space. (× 6.)
Hamilton group. *Near Canandaigua lake, N. Y.*

ACANTHOCLEMA SCUTULATUM.

Page 190.

See Plate 56.

Fig. 15. An enlargement of a longitudinal section, showing the filiform axis, the cell tubes and the intermediate tubuli formed by the nodes. (× 6.)
Hamilton group. *Near Dresden, N. Y.*
Fig. 16. An enlargement, showing the form and disposition of the cell apertures, the alternating nodes, and the longitudinal ridges not coalescing between the cell apertures. (× 6.)
Hamilton group. *Western New York.*
Fig. 17. An enlargement, showing the form and disposition of the cell apertures, the longitudinal ridges coalescing between the cell apertures, and the prominent nodes at the point of junction. (× 6.)
Hamilton group. *Near Dresden, N. Y.*

ACANTHOCLEMA HAMILTONENSE.

Page 191.

Fig. 18. An enlargement, showing the irregular form and disposition of the cell apertures; interapertural pits obsolete. (× 6.)
Fig. 19. A still farther enlargement, showing more plainly the characters represented in fig. 18. (× 18.)
Fig. 20. An enlargement, showing the form and disposition of the cell apertures, and the sinuous longitudinal ridges. (× 6.)
Hamilton group. *West Williams, Ontario, Canada.*
Fig. 21. An enlargement, showing the regular disposition of the cell apertures, the interapertural pits, and the sinuous ridges. (× 18.)
Hamilton group. *West Hamburg, Erie county, N. Y.*
Fig. 22. An enlargement of a longitudinal section, showing the intercellular structure; the section is a little to one side of the center of the branch, and consequently the filiform axis is not seen. (× 6.)
Fig. 23. An enlargement, showing both a regular and irregular disposition of the cell apertures. (× 6.)
Fig. 24. An enlargement from a macerated specimen, showing the spiral arrangement of the cell apertures more distinctly than the longitudinal. (× 18.)
Fig. 25. A still farther enlargement of the specimen represented by fig. 23, showing more distinctly the irregular form and disposition of the cell apertures. (× 18.)
Fig. 26. An enlargement, showing large cell apertures regularly disposed, the interapertural pits, and their sinuous ridges. (× 18.)
Hamilton group. *West Williams, Ontario, Canada.*

TREMATOPORA (ORTHOPORA) BISPINULATA.

Page 182.

See Plate 56.

Fig. 27. An enlargement, showing indistinct cell apertures, prominent nodes and interrupted longitudinal ridges. (× 6.)
Hamilton group. *Moscow, Livingston county, N. Y.*
Fig. 28. An enlargement of a longitudinal section, showing the internal structure near the surface, the cell tubes and the intercellular tubuli formed in the course of growth by the hollow nodes. (× 6.)
Fig. 29. An enlargement, showing the form and regular disposition of the cell apertures, the interapertural nodes and the longitudinal ridges. (× 6.)
Fig. 30. An enlargement, showing a regular disposition of the cell apertures, and also a somewhat irregular order above.
Hamilton group. *Darien, Genesee county, N. Y.*

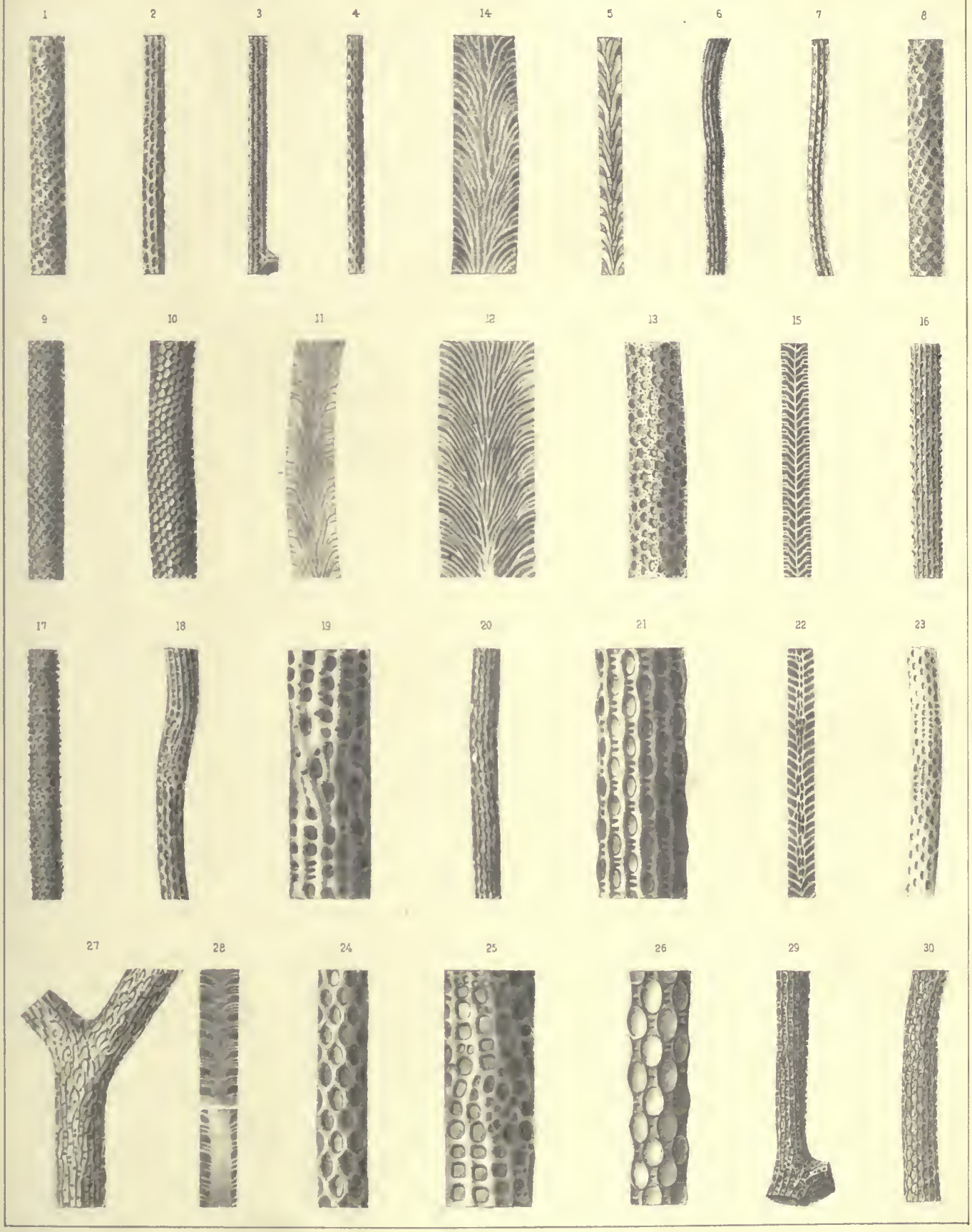
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PLATE LVI.

TREMATOPORA (ORTHOPORA) SUBQUADRATA.

Page 177.
See Plate 55.

Fig. 1. An enlargement, showing the form and disposition of the cell apertures and the character of the interapertural space. (× 18.)

Hamilton group. *Darien Centre, Genesee county, N. Y.*

Fig. 6. An enlargement, showing the cell apertures more broadly oval, and more closely disposed than in fig. 1. (× 18.)

Hamilton group. *Near Canandaigua Lake, N. Y.*

TREMATOPORA (ORTHOPORA) HEXAGONA.

Page 178.
See Plate 55.

Fig. 2. An enlargement, showing the form and disposition of the cell apertures, and the angular interapertural space. (× 18.)

Hamilton group. *Eighteen-mile-creek, Erie county, N. Y.*

TREMATOPORA (ORTHOPORA) CARINATA.

Page 179.
See Plate 55.

Fig. 3. An enlargement, showing the form and disposition of the cell apertures, the alternating nodes, and the prominent longitudinal ridges. (× 18.)

Hamilton group. *West Williams, Ontario, Canada.*

TREMATOPORA (ORTHOPORA) ORNATA.

Page 181.
See Plate 55.

Fig. 4. An enlargement, showing the form and disposition of the cell apertures, and the character of the interapertural surface. (× 18.)

Hamilton group. *Genesco, N. Y.*

TREMATOPORA (ORTHOPORA) RETICULATA.

Page 179.
See Plate 55.

Fig. 5. An enlargement, showing the form and disposition of the cell apertures, and the angular, granulose and nodose interapertural space. (× 18.)

Hamilton group. *Western New York.*

ACANTHOCLEMA SULCATUM.

Page 192.
See Plate 55.

Fig. 7. An enlargement, showing the form and disposition of the cell apertures, and the prominent angular ridges separating the ranges of apertures. (× 18.)

Hamilton group. *Darien Centre, Genesee county, N. Y.*

TREMATOPORA (ORTHOPORA?) ORBIPORA.

Page 188.
See Plate 55.

Fig. 8. An enlargement, showing the form and disposition of the cell apertures; on a portion of the figure the peristomes are obsolete, and the interapertural space elevated and nodose; on the other portion the peristomes are moderately strong, and the interapertural space is flat or slightly concave. (× 18.)

Hamilton group. *Near Canandaigua Lake, N. Y.*

TREMATOPORA (ORTHOPORA) TORTALINEA.

Page 180.

Fig. 9. An enlargement, showing the form and disposition of the cell apertures, and the sinuous, granulose ridges separating the ranges of apertures. (× 18.)
Hamilton group. *West Hamburg, Erie county, N. Y.*

TREMATOPORA (ORTHOPORA) LINEATA.

Page 181.

See Plate 55.

Fig. 10. An enlargement, showing the form and disposition of the cell apertures, the extremely thin, slightly elevated peristomes, and the prominent, granulose ridges separating the ranges of apertures. (× 18.)
Hamilton group. *West Hamburg, Erie county, N. Y.*

TREMATOPORA (ORTHOPORA) IMMERSA.

Page 185.

Fig. 11. An enlargement, showing the form and disposition of the cell apertures, and the character of the interapertural space. (× 18.)
Hamilton group. *West Hamburg, Erie county, N. Y.*

TREMATOPORA (ORTHOPORA) INTERPLANA.

Page 186.

Fig. 12. An enlargement, showing the form and disposition of the cell apertures, the slight peristomes, and the flat, granulose, interapertural space. (× 18.)
Hamilton group. *Western New York.*

TREMATOPORA (ORTHOPORA?) TRANSVERSA.

Page 187.

See Plate 55.

Fig. 13. An enlargement, showing the form and disposition of the cell apertures, and the flat, granulose interapertural space. (× 6.)
Fig. 14. A still farther enlargement, showing more distinctly the characters illustrated in fig. 13.
Hamilton group. *West Hamburg, Erie county, N. Y.*

TREMATOPORA (ORTHOPORA) ELONGATA.

Page 183.

See Plate 55.

Fig. 15. An enlargement, showing the form and disposition of the cell apertures, the extremely thin peristomes, and the granulose interapertural space. (× 18.)
Hamilton group. *Near the head of Owasco Lake, N. Y.*

TREMATOPORA (ORTHOPORA) BISPINULATA.

Page 182.

See Plate 55.

Fig. 16. An enlargement, showing elongate-oval, regularly disposed cell apertures, the alternating nodes and prominent longitudinal ridges. (× 18.)
Fig. 17. An enlargement, showing somewhat broadly oval cell apertures, regularly disposed in longitudinal rows, with two nodes between each two adjacent apertures, and sinuous longitudinal ridges. (× 18.)
Hamilton group. *Darien Centre, N. Y.*
Fig. 18. An enlargement, showing indistinct cell apertures, prominent nodes and interrupted longitudinal ridges. (× 18.)
Hamilton group. *Moscow, Livingston county, N. Y.*

ACANTHOCLEMA SCUTULATUM.

Page 190.

See Plate 55.

Fig. 19. An enlargement, showing regularly disposed cell apertures, and longitudinal ridges coalescing between the apertures, with nodes at their junction. (× 18.)
Fig. 20. An enlargement from a slightly macerated specimen, showing regularly disposed cell apertures, strong longitudinal ridges, and a node and pit between each two adjacent apertures. (× 18.)
Hamilton group. *West Hamburg, Erie county, N. Y.*

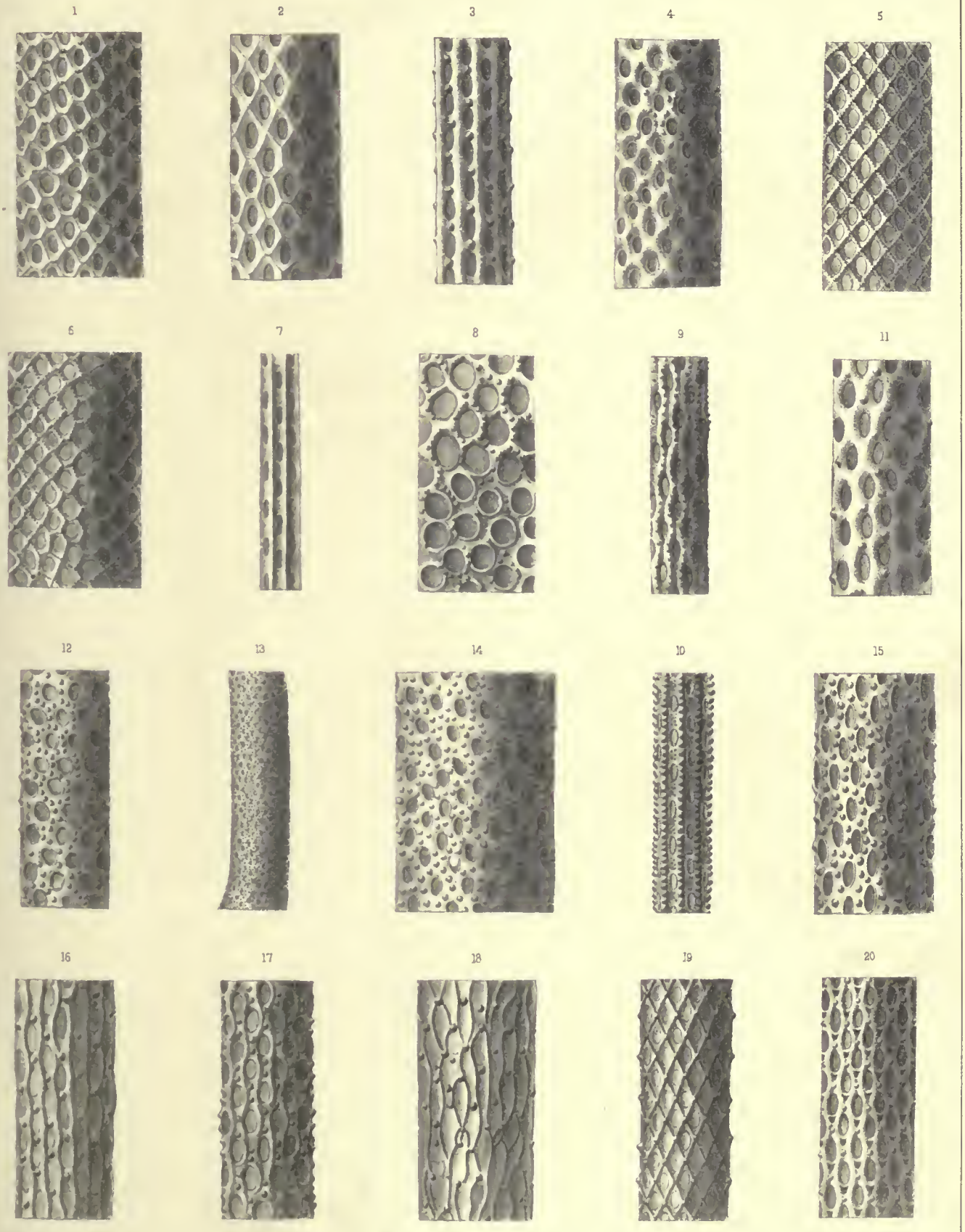
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PLATE LVII.

FISTULIPORA UNILINEA.

Page 217.

Fig. 1. An enlargement of a transverse section of the cell tubes, and intercellular vesicles. (× 18.)

Fig. 2. An enlargement of a transverse section, showing the form and disposition of the cell tubes, intercellular vesicles and one of the sterile maculæ. (× 6.)

Fig. 5. An enlargement of a vertical section, showing the form and manner of growth of the cell tubes and intercellular vesicles. (× 6.)

Hamilton group. *Near York, Livingston county, N. Y.*

FISTULIPORA SPHEROIDEA.

Page 225.

Fig. 3. An enlargement, showing more distinctly the characters illustrated in fig. 4. (× 18.)

Fig. 4. An enlargement, showing the form and disposition of the cell apertures, and mesopores. (× 6.)

Hamilton group. *York, Livingston county, N. Y.*

CERAMOPORA? (LICHENALIA) FOLIACEA.

Page 235.

Fig. 6. An enlargement, showing the form and disposition of the cell apertures, and one of the maculæ destitute of apertures. (× 6.)

Fig. 7. A still farther enlargement, showing more distinctly the form of the cell apertures. (× 18.)

Hamilton group. *Western New York.*

FISTULIPORA HEMISPHERICA.

Page 226.

Fig. 8. An enlargement, showing the form and disposition of the cell apertures, and interapertural pits. (× 6.)

Fig. 9. An enlargement, showing broadly oval or circular cell apertures, with strong peristomes, and elongate interapertural pits. (× 18.)

Fig. 10. An enlargement, showing subtrilobate cell apertures, and the interapertural pits obsolete on a large portion of the surface. (× 18.)

Fig. 11. An enlargement of a vertical section, showing the form and manner of growth of the cell tubes and the form and disposition of the intercellular vesicles. (× 6.)

Hamilton group. *Near York, Livingston county, N. Y.*

LICHENALIA BULLATA.

Page 205.

Fig. 12. An enlargement, showing very small cell apertures and large interapertural bullæ. (× 18.)

Fig. 13. An enlargement, showing cell apertures of normal size, their form and disposition, and the interapertural bullæ. (× 18.)

Hamilton group. *Near York, Livingston county, N. Y.*

PLATE LVII—Continued.

LICHENALIA VESICULATA.

Page 198.

See Plate 59.

Fig. 14. A specimen, natural size, showing the manner of growth upon a Cyathophylloid coral.

Figs. 15–17. Enlargements of vertical sections from different portions of the same frond, showing variations in the form and disposition of the intercellular vesicles. (× 6.)

Fig. 18. An enlargement, showing the form and disposition of the cell apertures, and a portion of one of the elongate depressed maculæ destitute of apertures. (× 6.)

Fig. 19. An enlargement of a transverse section, showing more distinctly the subtrilobate form of the cells, and the form of the intercellular vesicles. (× 6.)

Hamilton group. *York, Livingston county, N. Y.*

FISTULIPORA MICROPORA.

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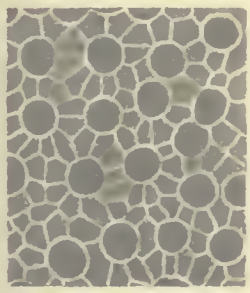
See Plate 59.

Fig. 20. An enlargement, showing the manner of growth of the frond, the form and disposition of the cell apertures, and interapertural pits. (× 6.)

Hamilton group. *West Hamburg, Erie county, N. Y.*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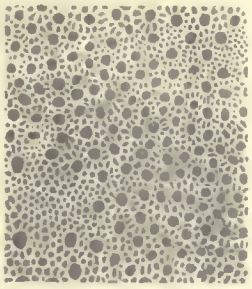
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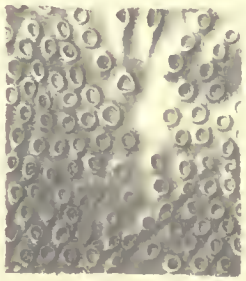
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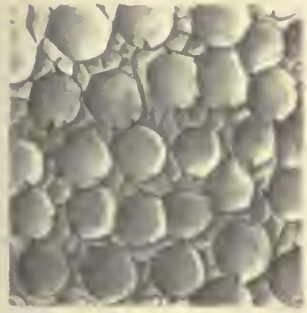
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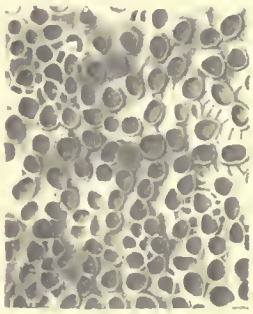
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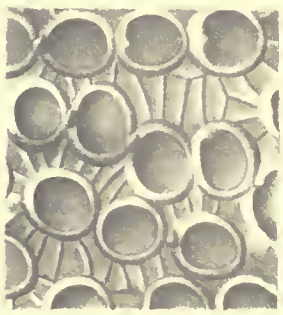
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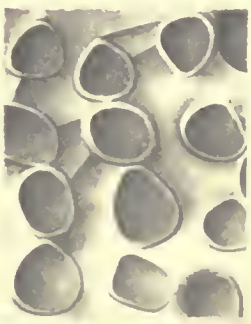
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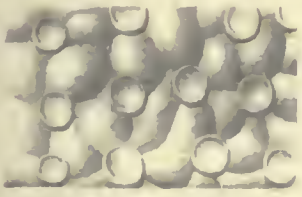
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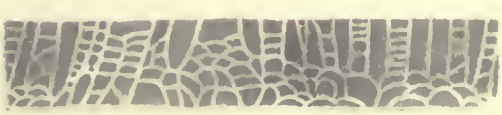
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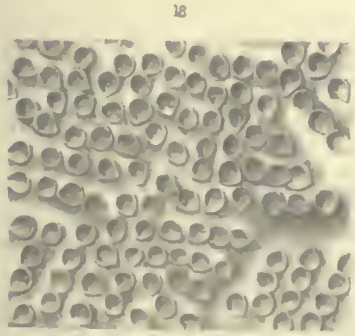
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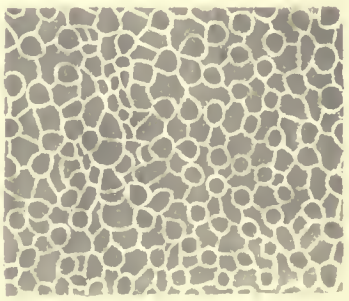
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PLATE LVIII.

FISTULIPORA CONFERTIPORA.

Page 211.

Fig. 1. An enlargement, showing the form and disposition of the cell apertures and interapertural pits; also one of the monticules, the centers of which are destitute of apertures. (× 6.)
Hamilton group. *Two miles east of Alden, N. Y.*

Fig. 2. A still farther enlargement, showing more distinctly the form of the cell apertures, the strong nodose peristomes and interapertural pits. (× 18.)
Hamilton group. *Moscow, Livingston county, N. Y.*

Fig. 3 An enlargement from another specimen, showing the cell apertures slightly oval, an unusual occurrence. (× 6.)
Hamilton group. *Two miles south of Darien Centre, N. Y.*

Fig. 4. An enlargement of a natural vertical section, showing the corrugated walls of the cell tubes. (× 6.)

Fig. 5. An enlargement of a translucent vertical section, showing the septate cell tubes, and the form and disposition of the intercellular vesicles. (× 6.)
Hamilton group. *Two miles east of Alden, N. Y.*

FISTULIPORA SERRULATA.

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Fig. 6. An enlargement, showing the form and disposition of the cell apertures and interapertural pits; also a portion of one of the monticules destitute of cell apertures. (× 6.)

Fig. 7. A still farther enlargement, showing more distinctly the form of the cell apertures and interapertural pits, and the opercula of the apertures. (× 18.)
Hamilton group. *York, Livingston county, N. Y.*

Fig. 8. An enlargement of a portion of another specimen, which has the interapertural pits obsolete. (× 18.)
Hamilton group. *Moscow, Livingston county, N. Y.*

FISTULIPORA VARIAPORA.

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Fig. 9. An enlargement of a transverse section. (× 18.)
Hamilton group. *Western New York.*

Fig. 10. An enlargement of one of the monticules, showing the form and disposition of the cell apertures and interapertural pits. (× 6.)

Fig. 11. An enlargement of a vertical section, showing the septate cell tubes, and the intercellular vesicles forming tubuli with very closely disposed septa. (× 6.)
Hamilton group. *West Williams, Ontario, Canada.*

Fig. 12 An enlargement of a natural vertical section, showing the form of the cell tubes, and the vesicles disposed as tubuli. (× 6.)

Fig. 13. An enlargement of a vertical section, showing the septate cell tubes, and the vesicles disposed as tubuli, with septa more distant than in fig. 11. (× 6.)

Fig. 14. An enlargement of a vertical section. (× 6.)
Hamilton group. *York, Livingston county, N. Y.*

LICHENALIA STELLATA.

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Fig. 15. An enlargement of one of the monticules, showing the form and disposition of the cell apertures. (× 6.)
Hamilton group. *West Bloomfield, Ontario county, N. Y.*

Fig. 16. An enlargement of a vertical section, showing the cell tubes, and the intercellular vesicles disposed as tubuli. (× 6.)
Hamilton group. *West Williams, Ontario, Canada.*

PLATE LVIII—Continued

FISTULIPORA SCROBICULATA.

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Fig. 17. An enlargement, showing the form and disposition of the cell apertures and interapertural pits, and a portion of one of the maculæ destitute of cell apertures. (× 6.)

Fig. 18. A still farther enlargement, showing more distinctly the form of the cell apertures and interapertural pits. (× 18.)

Hamilton group. *York, Livingston county, N. Y.*.

FISTULIPORA PLANA.

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Fig. 19. An enlargement, showing the form and disposition of the cell apertures; the specimen is covered with a thin incrustation which obscures the interapertural pits over a portion of the surface. (× 6).

Fig. 20. A still farther enlargement, showing more distinctly the form of the cell apertures. (× 18.)

Hamilton group. *Near Canandaigua Lake, N. Y.*

FAVICELLA INCLUSA.

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Fig. 21. An enlargement, showing the form and disposition of the cell apertures, the angular elevations surrounding them, the interapertural pits, and the monticules, the centers of which are destitute of cell apertures. (× 6.)

Fig. 22 A still farther enlargement, showing more distinctly the cell apertures, the surrounding elevations and interapertural pits. (× 18.)

Fig. 23. A vertical section, showing the manner of growth of the cell tubes and the intermediate vesiculose structure. (× 6)

Hamilton group. *York, Livingston county, N. Y.*

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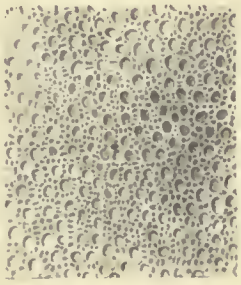

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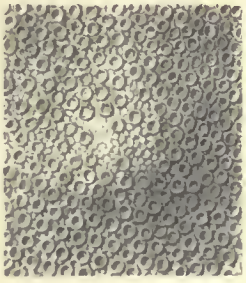

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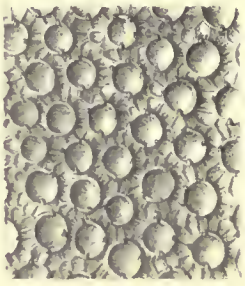

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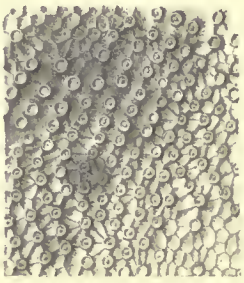

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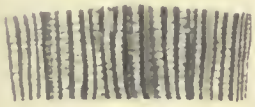

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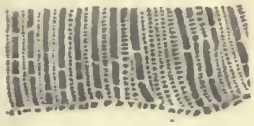

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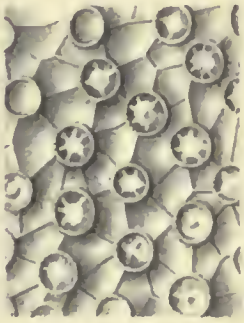

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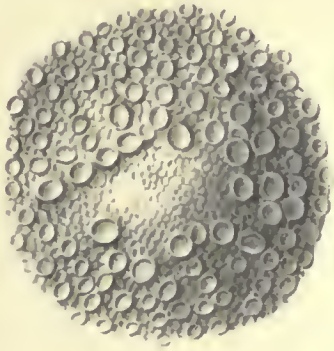

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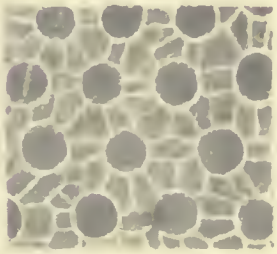

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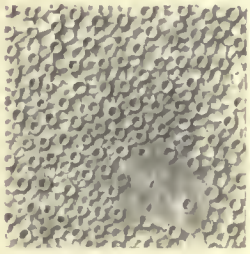

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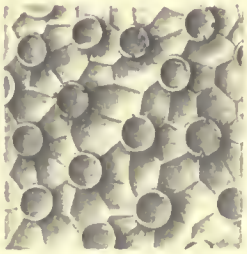

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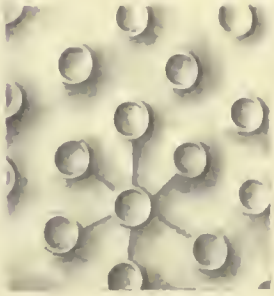

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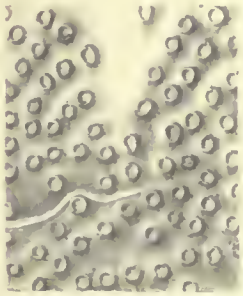

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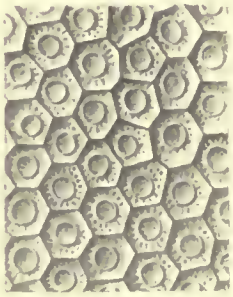

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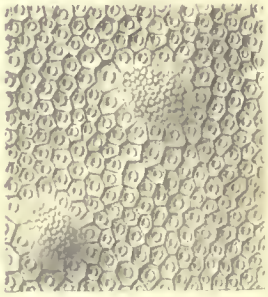

PLATE LIX.

LICHENALIA VESICULATA.

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See Plate 57.

Fig. 1. An enlargement, showing trilobate cell apertures. (× 18.)
Hamilton group. *Four miles south of Le Roy, Genesee county, N. Y.*

Fig. 14. An enlargement, showing a depressed stelliform macula, and the form and disposition of the adjacent cell apertures. (× 6.)
Hamilton group. *Darien, N. Y.*

FISTULIPORA INVOLVENS.

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Fig. 2. An enlargement, showing the form and disposition of the cell apertures and mesopores. (× 6.)
Hamilton group. *East of Alden Station, N. Y.*

FISTULIPORA MICROPORA.

Page 220.

See Plate 57.

Fig. 3. An enlargement, showing the form and disposition of the cell apertures and mesopores more distinctly than in fig. 20. pl. 57. (× 18.)
Hamilton group *West Hamburg, Erie county, N. Y.*

FISTULIPORA SEGREGATA.

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Fig. 4. An enlargement, showing circular cell apertures, and numerous mesopores. (× 18.)
Hamilton group. *West Hamburg, Erie county, N. Y.*

FISTULIPORA MINUTA.

Page 223.

Fig. 5. An enlargement, showing the form and disposition of the cell apertures and mesopores; they are nearly equally prominent and so disposed that their margins give to the surface a striated appearance. (× 18.)

Fig. 6. An enlargement from a slightly macerated portion of the same frond, showing the cell apertures much more prominent than the mesopores. (× 18.)

Fig. 7. An enlargement from another portion of the same frond, showing some of the apertures to be subtrilobate. (× 18.)
Hamilton group. *West Hamburg, Erie county, N. Y.*

Fig. 8. An enlargement from another specimen, showing elongate oval cell apertures. (× 18.)
Hamilton group. *Delphi, Onondaga county, N. Y.*

FISTULIPORA DECIPIENS.

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Fig. 9. An enlargement, showing the form and disposition of the cell apertures; the lower portion of the figure is worn, and the apertures are larger than when the surface is well preserved.
Hamilton group. *York, Livingston county, N. Y.*

PLATE LIX—Continued.

FISTULIPORA MULTACULEATA.

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Fig. 10. An enlargement of a specimen incrusting a Cyathophylloid coral, showing the manner of growth, and the form and disposition of the cell apertures and mesopores. (× 6.)

Fig. 11. A still farther enlargement, showing more distinctly the form and disposition of the cell apertures and the numerous nodes on their margins. (× 18.)

Hamilton group. *Darien, N. Y.*

FISTULIPORA DIGITATA.

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Fig. 12. An enlargement of a specimen incrusting a Cyathophylloid coral, showing the manner of growth, and the form and disposition of the cell apertures and mesopores (× 6.)

Fig. 13. A still farther enlargement, showing more distinctly the form and disposition of the cell apertures and mesopores, and the prominent nodes between the apertures. (× 18.)

Hamilton group *York, Livingston county, N. Y.*

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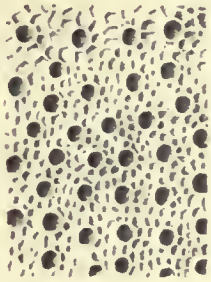

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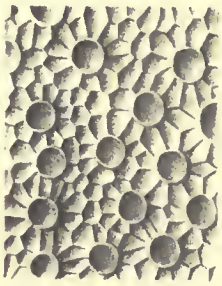

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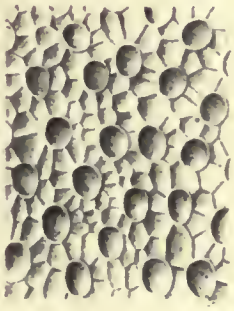

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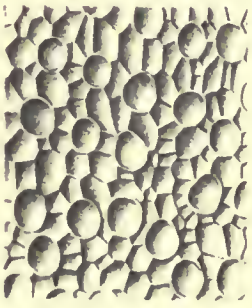

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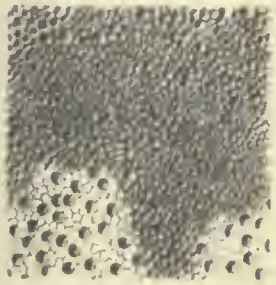

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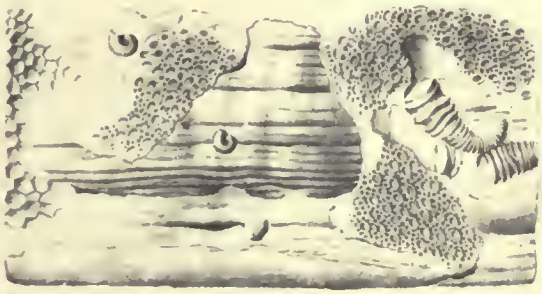

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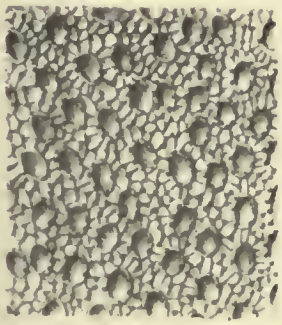

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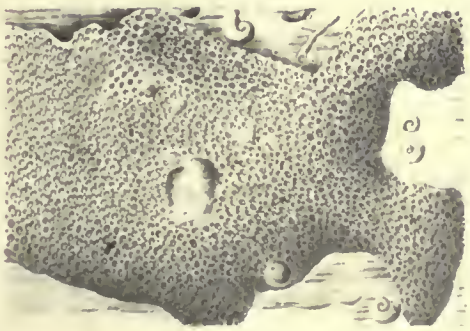

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PLATE LX.

STICTOPORA INCISURATA.

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Fig. 1. A part of a frond, natural size, showing its form and manner of growth.
Hamilton group. *Near Muttonville, township of North Bristol, Ontario county, N. Y.*

Fig. 2. An enlargement, showing decidedly serrulate margins. (× 6.)
Hamilton group. *Kashong creek, Bellona, Yates county, N. Y.*

Fig. 3. An enlargement from another frond, showing irregularly disposed, oblique cell apertures, originally described as *Stictopora obliqua*. (× 6.)
Hamilton group. *Near Lodi Landing, Seneca Lake, N. Y.*

Fig. 4. An enlargement of a section, showing the intercellular vesicles. (× 6.)
Hamilton group. *Lodi Landing, N. Y.*

Fig. 5. An enlargement, showing the rootlets and pedicel of a frond. All the bases observed have a similar appearance to this one. (× 6.)

Fig. 6. An enlargement, showing very oblique cell apertures, disposed in essentially parallel longitudinal rows. (× 6.)
Hamilton group. *Full-brook, four miles east of Canandaigua Lake, N. Y.*

Fig. 7. An enlargement of a narrow branch, showing oval cell apertures, where the ranges are separated by strong striæ. (× 6.)
Hamilton group. *Near Muttonville, North Bristol township, Ontario county, N. Y.*

Fig. 8. An enlargement, showing broad, flattened, longitudinal striations. (× 6.)
Hamilton group. *Full-brook, Ontario county, N. Y.*

Fig. 9. An enlargement, showing the cell apertures very closely disposed. (× 6.)
Hamilton group. *In the vicinity of Genesco, N. Y.*

Fig. 10. A still farther enlargement, showing more distinctly the characters illustrated in the preceding figure. (× 18.)

Fig. 11. An enlargement, showing the most common appearance of the surface of a frond. (× 6.)
Hamilton group. *Near Lodi Landing, Seneca lake, N. Y.*

Fig. 12. An enlargement of a broad frond having simple longitudinal striations. (× 6.)
Hamilton group. *Norton's Landing, Cayuga lake, N. Y.*

Fig. 13. An enlargement, showing lunate projections from the outer margins of the peristomes. (× 18.)
Hamilton group *Kashong creek, Bellona, Yates county, N. Y.*

Fig. 14. A still farther enlargement of one cell aperture. (× 60.)

Fig. 15. An enlargement, showing regularly disposed oblique cell apertures. (× 6.)

Fig. 16. An enlargement, showing prominent denticulated projections from the posterior portion of the cell apertures. (× 18.)
Hamilton group. *Near Muttonville, North Bristol township, Ontario county, N. Y.*

Fig. 17. A fragment, natural size.

Fig. 18. Enlargements of transverse sections of different fronds. (× 6.)

STICTOPORA PALMIPES.

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Fig. 19. A frond, natural size, showing the base and manner of growth.

Fig. 20. An enlargement from the preceding, showing the broad non-celluliferous margin, the oval cell apertures, with slight peristomes, and the nodose longitudinal ridges. (× 18.)
Hamilton group. *Near Pavilion, N. Y.*

PLATE LX—Continued.

STICTOPORA SUBRIGIDA.

Page 251.

Fig. 21. An enlargement, showing the form and disposition of the cell apertures, and the longitudinal ridges. (× 6.)

Hamilton group. *Two and one-half miles east of Alden Station, N. Y.*

STICTOPORA CRENULATA.

Page 252.

Fig. 22. An enlargement, showing the form and disposition of the cell apertures, the striations separating them and the crenulated margins of the frond. (× 6.)

Hamilton group. *Two and one-half miles east of Alden Station, N. Y.*

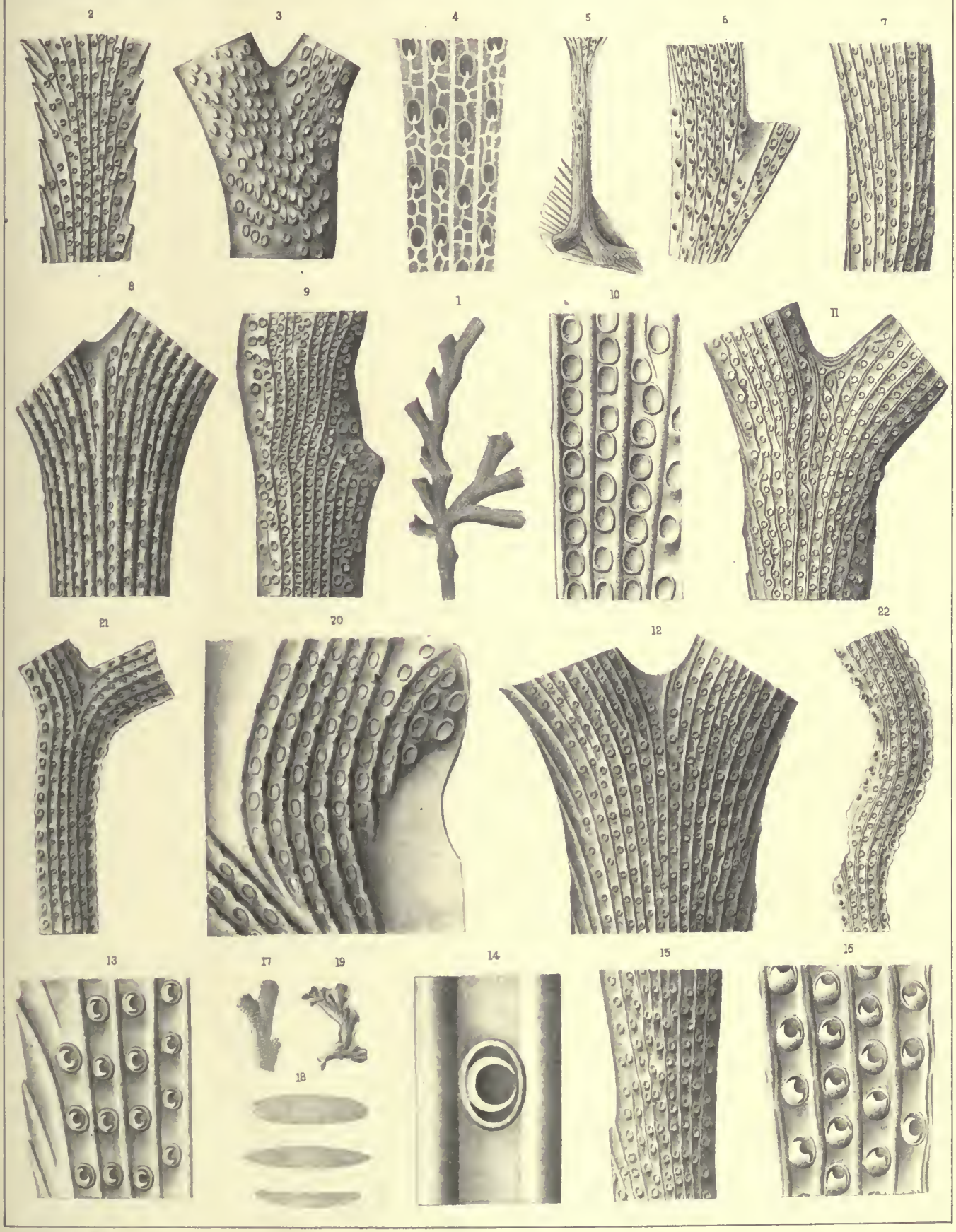
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PLATE LXI.

STICTOPORA GRANIFERA.

Page 257.

Fig. 1. A fragment of a frond, natural size, showing wide branches, much enlarged before bifurcation.
Hamilton group. *One mile north of Pavilion Village, Genesee county, N. Y.*

Fig. 2. An enlargement of a portion of another frond having narrower branches.
Hamilton group. *North Bristol township, Ontario county, N. Y.*

Fig. 3. An enlargement, showing the cell apertures obscured by the granulose striations. (× 6.)

Fig. 4. An enlargement, showing the form and disposition of the cell apertures, which are unusually distinct in this specimen. (× 6.)
Hamilton group. *Full-brook, four miles east of Canandaigua lake, N. Y.*

Fig. 5. An enlargement, showing the cell apertures with granulose peristomes, and intermediate striæ. (× 18.)
Hamilton group. *York, Livingston county, N. Y.*

Fig. 6. An enlargement of transverse sections of two fronds.

PTILODICTYA PARALLELA.

Page 270.

Fig. 7. A fragment of a frond, natural size.

Fig. 8. An enlargement from the preceding, showing the form and arrangement of the cell apertures and the longitudinal striations. (× 6.)
Hamilton group. *Full-brook, four miles east of Canandaigua lake, Ontario county, N. Y.*

PTILODICTYA PLUMEA.

Page 271.

Fig. 9. A part of a frond, natural size, showing the manner of growth, and the frequent monticules of the surface.

Fig. 10. An enlargement from the portion of the frond immediately above fig. 11, showing oval cell apertures between the longitudinal striations. (× 18.)

Fig. 11. An enlargement of the base of the specimen fig. 9, showing the truncate apex, and striated portion above. (× 18.)

Fig. 12. An enlargement from the same frond, showing the form and disposition of the cell apertures, and the elevated, granulose intermediate space. (× 6.)
Hamilton group *West Hamburg, Erie county, N. Y.*

PTILODICTYA RETIFORMIS.

Page 272.

Fig. 13. An enlargement, showing the form and disposition of the cell apertures and the reticulate appearance of the surface. (× 6.)
Hamilton group. *Alden, Erie county, N. Y.*

STICTOPORA LIMATA.

Page 250.

Fig. 14. A fragment, natural size.

Fig. 15. An enlargement from the preceding, showing the small cell apertures and broad longitudinal ridges. (× 6.)

Fig. 16. An enlargement of a narrower form, with less prominent longitudinal ridges. (× 6.)
Hamilton group. *Darien Centre, N. Y.*

PLATE LXI—Continued.

STICTOPORA SINUOSA.

Page 247.

Fig. 17. An enlargement, showing the form and disposition of the cell apertures, and the strong sinuous striations. (× 18.)

Hamilton group. *South of Auburn, on the shore of Cayuga lake, N. Y.*

STICTOPORA TUMULOSA.

Page 246.

Fig. 18. An enlargement, showing slightly pustuliform cell apertures, separated by longitudinal striations. (× 18.)

Fig. 19. An enlargement from another portion of the same frond, showing decidedly pustuliform cell apertures, irregularly disposed. (× 18.)

Hamilton group. *Vicinity of Geneseo, Livingston county, N. Y.*

Fig. 20. An enlargement, showing the obtuse distal extremity of a specimen, and the disposition of the cell apertures in longitudinal parallel rows, separated by striations. (× 6.)

Fig. 21. A still further enlargement, showing more distinctly the pustuliform cell apertures. (× 18.)

Fig. 22. An enlargement from another specimen, showing a finely granulose surface. (× 18.)

Hamilton group. *Moscow, Livingston county, N. Y.*

STICTOPORA ANGULARIS.

Page 252.

Fig. 23. An enlargement, showing both the oval and circular pustulose cell apertures, separated by longitudinal ridges.

Hamilton group. *Four miles south of Le Roy, N. Y.*

STICTOPORA SCITULA, n. sp.

Fig. 24. An enlargement, showing the form and disposition of the cell apertures, and the longitudinal striations. (× 6.)

Fig. 25. A still further enlargement, showing more distinctly the characters represented in fig. 24. (× 18.)

Formation and locality. *Niagara group, Lockport, N. Y.*

This fossil is one of a collection purchased from the estate of the late Mr. Pickett of Rochester, N. Y., and was originally arranged with the collections of the Hamilton group, the specimen differing in no appreciable character from the Hamilton shale. It was only after it had been drawn and lithographed, that, finding no other specimen of the species in the extensive collections of the Hamilton group, critical attention was directed to it, when a small fragment of *Spirifera Niagarensis* was found in the shale, and from the presence of this fossil the Geological age has been determined.

STICTOPORA TRILINEATA.

Page 213.

Fig. 26. An enlargement from near the base of the frond, showing the striations extending over the entire surface. (× 6.)

Fig. 27. An enlargement, showing the circular cell apertures, with equally elevated, smooth peristomes, and disposed in longitudinal parallel rows separated by striations. (× 18.)

Hamilton group. *Moscow, Livingston county, N. Y.*

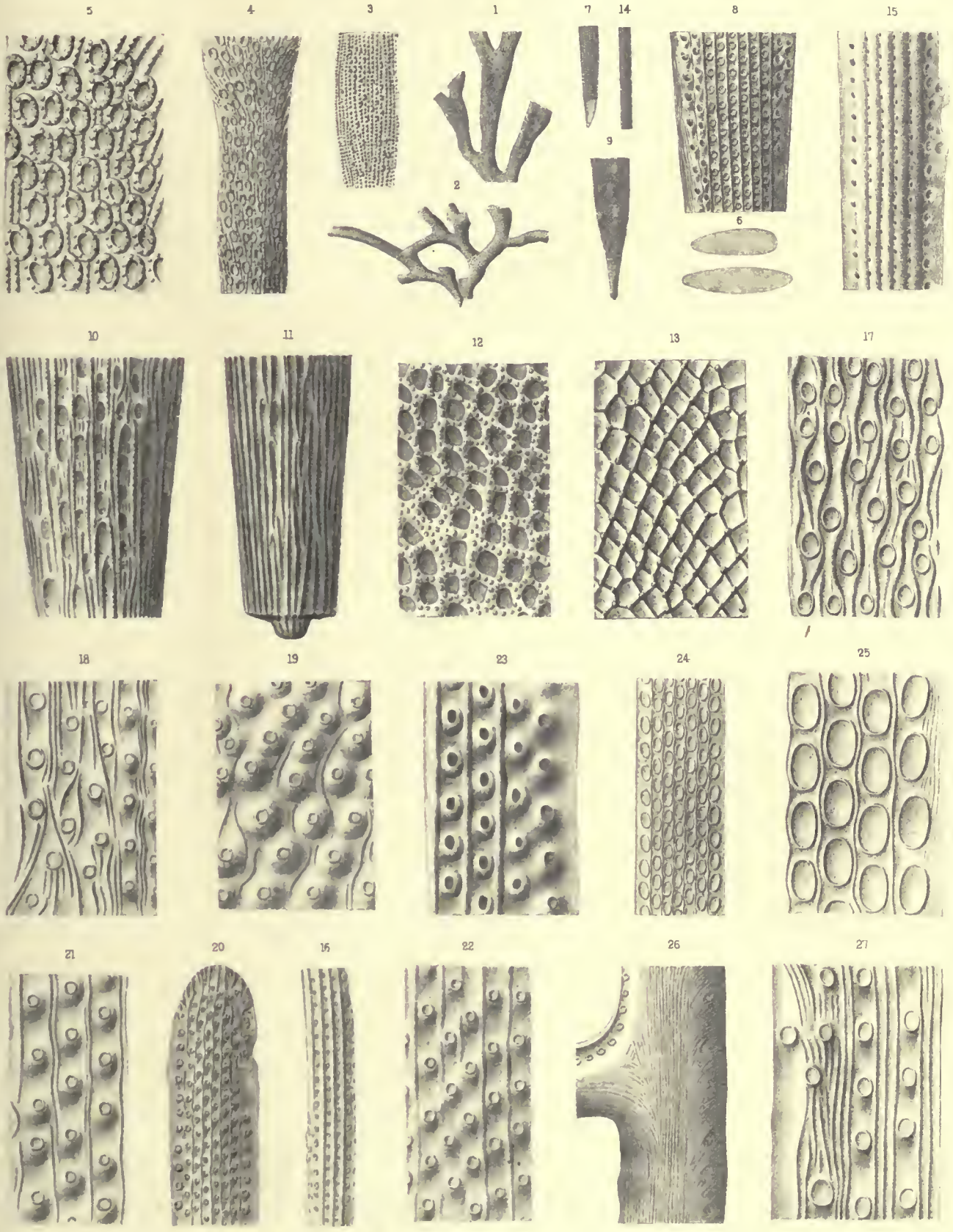
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PLATE LXII.

STICTOPORA INCRASSATA.

Page 249.

Fig. 1. A fragment, natural size.

Fig. 2 An enlargement, showing the longitudinal disposition of the obovate cell apertures, the equally elevated peristomes and the sinuous ridges dividing the ranges of apertures. (× 6)

Fig. 3. A still further enlargement, showing more distinctly the characters represented in fig. 2. (× 18.)

Fig. 4. An enlargement, showing the cell apertures with nodulose opercula, their arrangement, and the flattened space between the rows of apertures. (× 6.)

Fig. 5. A still further enlargement, showing more distinctly the characters represented in fig. 4. (× 18.)

Fig. 6. An enlargement of the transverse section of a frond. (× 6.)

Hamilton group. *West Williams, Ontario, Canada.*

STICTOPORA INTERSTRIATA.

Page 259.

Fig. 7. A fragment, natural size, showing the form and manner of growth.

Fig. 8. An enlargement, showing the form and disposition of the cell apertures, the equally elevated peristomes, the spinuliform projections, and the striated, non-celluliferous marginal space. (× 6.)

Fig. 9. A still further enlargement, showing more distinctly most of the features represented in fig. 8. (× 18.)

Fig. 10. A still further enlargement of one of the cell apertures, showing more distinctly the spiniform projections from the interior. (× 70.)

Hamilton group. *Full-brook, Onlario county, N. Y.*

Fig. 11. An enlargement of the frond at a bifurcation, showing numerous longitudinal striations obscuring the cell apertures. (× 6.)

Fig. 12. An enlargement; the greater portion showing the mesotheca, with markings caused by the recumbent portion of the cell tubes; the upper part shows the appearance of the cell apertures when the frond is macerated. (× 6.)

Hamilton group. *Near Alden, Erie county, N. Y.*

PRISMOPORA DILATATA.

Page 265.

Fig. 13. A fragment, natural size.

Fig. 14. An enlargement of a portion of fig. 13, showing the form and arrangement of the cell apertures. (× 6.)

Hamilton group. *Three miles south-west of Leonardsville, Madison county, N. Y.*

PLATE LXII—Continued.

TÆNIOPORA EXIGUA.

Page 263.

Fig. 15. A fragment of a frond, natural size.
Hamilton group. *Near Dresden, N. Y.*

Fig. 16. An enlargement, showing the usual appearance of the frond, and the form and disposition of the cell apertures. (× 6.)
Hamilton group. *Genesco, Livingston county, N. Y.*

Fig. 17. An enlargement of a portion of a narrower frond, showing only four ranges of cell apertures. (× 6.)
Hamilton group. *Four miles east of Canandaigua lake, N. Y.*

Fig. 18. An enlargement of a transverse section, showing the form and mode of growth of the cell tubes. (× 6.)

Fig. 19. An enlargement, showing the recumbent part of the cell tubes and their increasing obliquity to the longitudinal axis of the branch. (× 6.)
Hamilton group. *Eighteen-mile-creek, Erie county, N. Y.*

Fig. 20. A transverse section of a branch, showing the intercellular, vesiculose tissue. (× 6.)

Fig. 21. An enlargement of a transverse section from another frond, showing a much stronger carina than in fig. 20. (× 6.)
Hamilton group. *Dresden, N. Y.*

Fig. 22. A fragment, natural size; the main branch is triangular, the lateral branches flattened. (× 6.)

Fig. 23. An enlargement, showing two sides of the triangular main branch, and flattened lateral branches. (× 6.)

Fig. 24. An enlargement from fig. 22, showing a concave face of the triangular main branch, and the form and arrangement of the cell apertures. (× 6.)

Fig. 25. An enlargement from fig. 23, showing two faces of the triangular main branch, and two flattened lateral branches. (× 6.)

Fig. 26. A transverse section of the triangular main branch.
Hamilton group. *From loose specimens of the rock at Unadilla Forks, Otsego county, N. Y.*

SEMIOPORA BISTIGMATA.

Page 262.

Fig. 27. A fragment of a frond, natural size.

Fig. 28. An enlargement, showing the form and arrangement of the cell apertures, the interapertural pits, and the striated non-celluliferous margins. (× 6.)

Fig. 29. An enlargement of a transverse section. (× 6.)
Hamilton group. *West Williams, Ontario, Canada.*

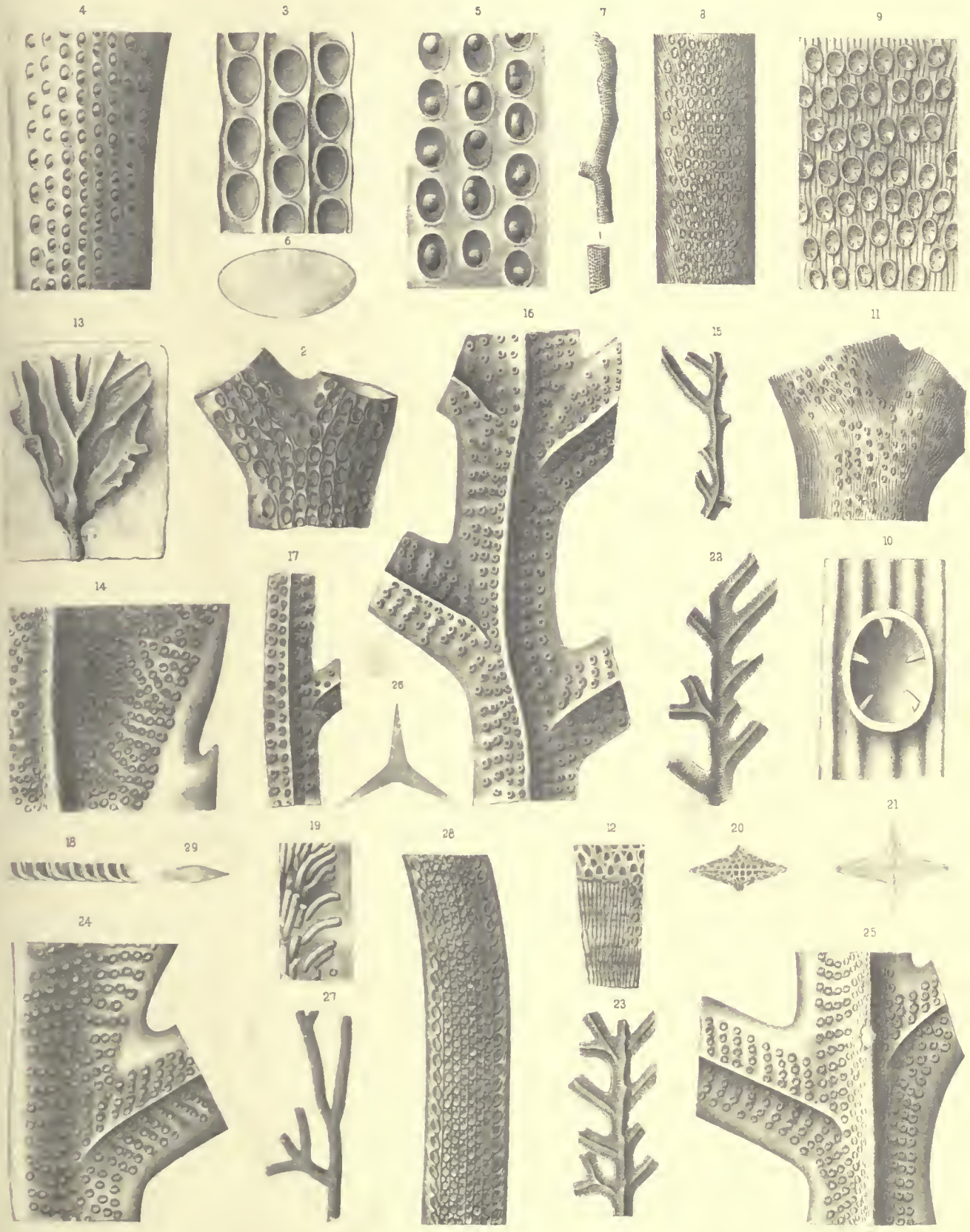
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PLATE LXIII.

STICTOPORA SUBCARINATA.

Page 261.

Fig. 1. A fragment, natural size.
Hamilton group. *Bellona, Yates county, N. Y.*

Fig. 2. An enlargement from a decidedly angular specimen, showing the form and arrangement of the cell apertures, and a single ridge along the middle of the branch. (× 6.)

Fig. 3. A still farther enlargement, showing more distinctly the character of the cell apertures. (× 18.)

Fig. 4. An enlargement from another branch of the same frond, showing a more flattened form, and a more irregular disposition of the cell apertures. (× 6.)
Hamilton group. *Darien Centre, Genesee county, N. Y.*

Fig. 5. An enlargement from another frond, showing several ranges of apertures separated by striations or ridges. (× 6.)

Fig. 6. A still further enlargement, showing more distinctly the longitudinal ridges and the character of the cell apertures. (× 18.)
Hamilton group. *Bellona, Yates county, N. Y.*

ACROGENIA PROLIFERA.

Page 267.

Fig. 7. A frond, natural size, showing the rootlets and manner of growth.

Fig. 8. An enlargement from the preceding, showing more distinctly the character of the roots. (× 3.)

Fig. 9. An enlargement of the base of a branch, showing the conical, truncated apex, and the striated portion above. (× 6.)
Hamilton group. *Vicinity of Muttonville, North Bristol township, Ontario county, N. Y.*

Fig. 10. An enlargement from near the base of a branch from another frond, showing a different character of striation from the preceding. (× 6.)

Fig. 11. A still further enlargement from near the margin, showing the character of the striation. (× 18.)
Hamilton group. *One mile north of Pavilion Village, Genesee county, N. Y.*

Fig. 12. An enlargement, showing the conically truncated base, striated longitudinal ridges, with ranges of cell apertures between them. (× 6.)
Hamilton group. *Near Lodi Landing, Seneca lake, N. Y.*

Fig. 13. An enlargement, showing the form and arrangement of the denticulated cell apertures, and the longitudinal ridges. (× 6.)
Hamilton group. *Darien Centre, Genesee county, N. Y.*

Fig. 14. An enlargement, showing prominent denticulations which have the appearance of circular cell apertures. (× 6.)
Hamilton group. *Eighteen-mile-creek, Erie county, N. Y.*

Fig. 15. Enlargements of transverse sections from different portions of a branch, *a*, near the apex, *b*, a little above, *c*, from the flattened part of the branch.
Hamilton group. *Vicinity of Muttonville, North Bristol township, Ontario county, N. Y.*

STICTOPORA PERMARGINATA.

Page 258.

Fig. 16. An enlargement, showing the form and arrangement of the cell apertures. (× 18.)
Hamilton group. *West Hamburg, Erie county, N. Y.*

STICTOPORA BIFURCATA.

Page 254.

Fig. 17. An enlargement, showing the mode of growth, the form and arrangement of the cell apertures, and the longitudinal nodose ridges. (× 6.)
Hamilton group. *Near Muttonville, North Bristol township, Ontario county, N. Y.*

PLATE LXIII—Continued.

STICTOPORA DIVERGENS.

Page 257.

Fig. 18. Fragments, natural size.

Fig. 19. An enlargement, showing the form and arrangement of the cell apertures, and the granulose striations. (× 6.)

Hamilton group. *Darien Centre, N. Y.*

STICTOPORA RECUBANS.

Page 260.

Fig. 20. A fragment, natural size.

Fig. 21. An enlargement, showing the form and arrangement of the cell apertures. (× 6.)

Hamilton group. *Shore of Seneca lake, N. Y.*

STICTOPORA STRIATA.

Page 246.

Fig. 22. An enlargement, showing the form and arrangement of the cell apertures, the strong peristomes, and numerous short striations.

Hamilton group. *Genesee valley, N. Y.*

STICTOPORA RECTALINEA.

Page 245.

Fig. 23. An enlargement, showing the form of the cell apertures, and their disposition in longitudinal, parallel rows, separated by striated ridges. (× 6.)

Hamilton group. *West Williams, Ontario, Canada.*

STICTOPORA OVATA.

Page 248.

Fig. 24. An enlargement, showing the form and arrangement of the cell apertures, the strong peristomes, and the thin, angular, longitudinal striations. (× 6.)

Hamilton group. *Fall-brook, four miles east of Canandaigua lake, N. Y.*

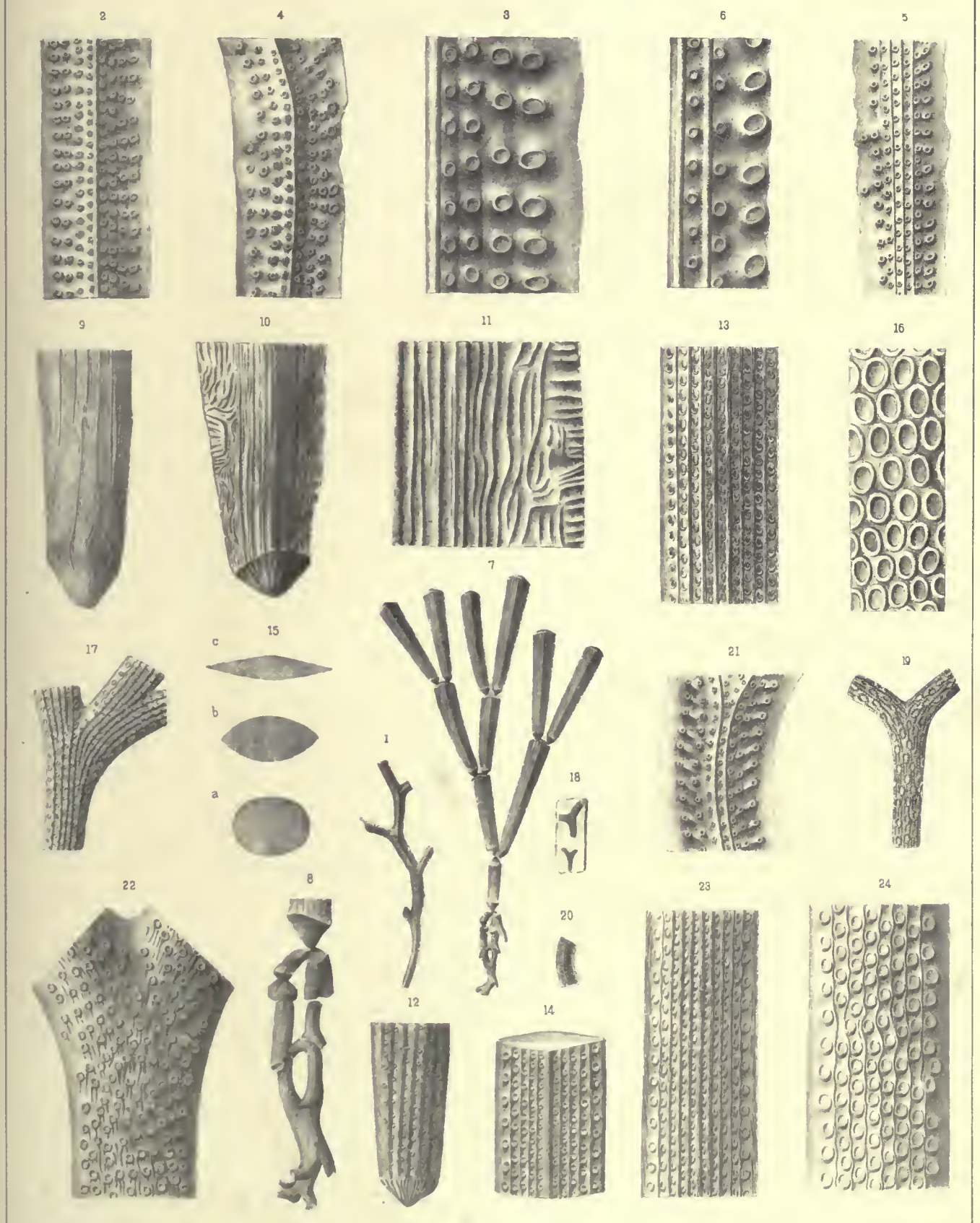
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PLATE LXIV.

Lichenalia cultellata.

Page 202.

Fig. 1. An enlargement of one of the monticules, showing the form and disposition of the cell apertures; usually the cell apertures are trilobate. (× 6.)

Fig. 2. A still farther enlargement of the center of the monticule, showing the ridges extending from the center to the adjacent cell apertures. (× 18.)

Hamilton group. *Fall-brook, four miles east of Canandaigua lake, on the old Geneva road, Ontario county, N. Y.*

Botryllopora socialis.

Page 282.

Fig. 3. An enlargement, showing the general appearance of a specimen, the arrangement of the cell apertures, and the bullæ of the surface. (× 6.)

Fig. 4. An enlargement of a vertical section, showing the form and mode of growth of the cell tubes, and the intercellular vesicles. (× 6.)

Hamilton group. *York, Livingston county, N. Y.*

Ceramella scidacea.

Page 240.

Fig. 5. A fragment of a frond, natural size, showing the form and arrangement of the maculæ.

Fig. 6. An enlargement, showing one of the maculæ, and the form and disposition of the cell apertures. (× 6.)

Hamilton group. *Shurger's Glen, Norton's Landing, Cayuga lake, N. Y.*

Fig. 7. A fragment of a frond, natural size, showing narrow, elongate maculæ; the surface is macerated.

Fig. 8. An enlargement from the preceding, showing one of the maculæ, and the appearance of the macerated surface.

Hamilton group. *Near Alexander, Genesee county, N. Y.*

Coscinella elegantula.

Page 239.

Fig. 9. A part of a frond, natural size, showing the general appearance, the radiation, and the form and disposition of the fenestrules or perforations.

Fig. 10. An enlargement from the preceding, showing the form and disposition of the cell apertures, the intermediate pits, and the pits surrounding the fenestrules. (× 6.)

Fig. 11. An enlargement of a vertical section, showing the form and manner of growth of the cell tubes, and the intercellular vesicles. (× 6.)

Fig. 12. An enlargement of a transverse section, showing the form of the frond between the fenestrules. (× 6.)

Hamilton group. *Widder, Ontario, Canada.*

Coscinium striatum.

Page 238.

Fig. 13. A part of a frond, natural size, showing the general appearance, and the form and disposition of the fenestrules.

Fig. 14. An enlargement from the preceding, showing the disposition of the cell apertures, the intermediate striations, and the non-celluliferous space bordering the fenestrules. (× 6.)

Fig. 15. A still further enlargement, showing circular cell apertures, slight, denticulated peristomes, and the intermediate nodes and striæ. (× 18.)

Fig. 16. An enlargement from another portion of the same frond, showing oval cell apertures; the other characters being similar to those of the preceding figure. (× 18.)

Hamilton group. *West Williams, Ontario, Canada.*

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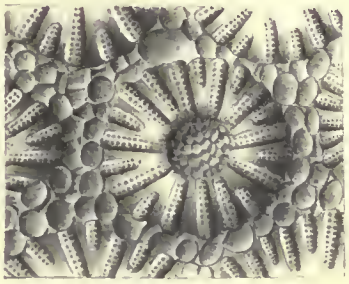

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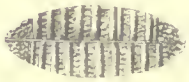

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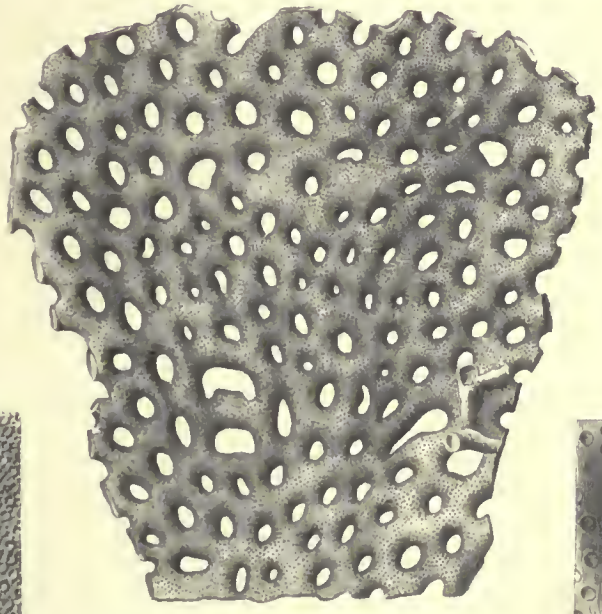

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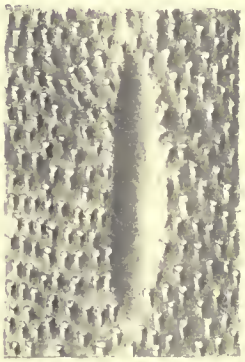

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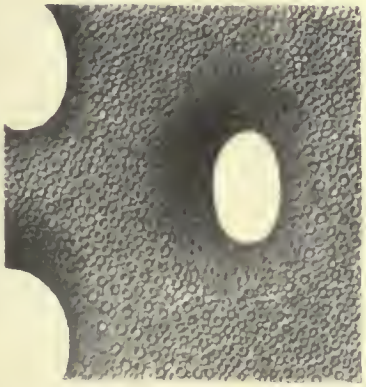

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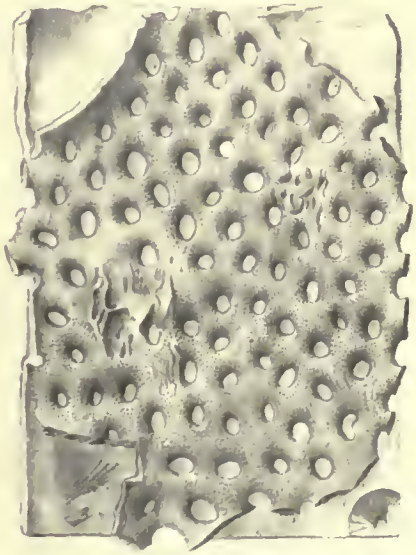

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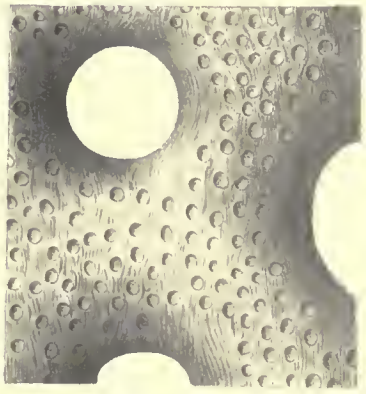

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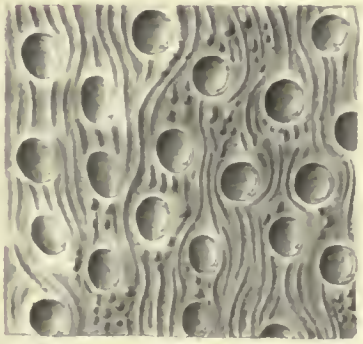

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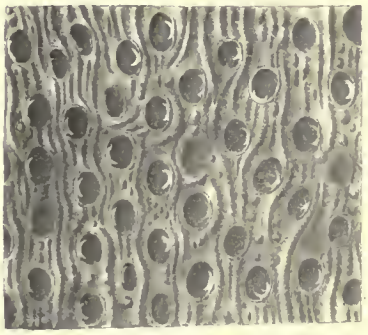

PLATE LXV.

Hederella Canadensis.

Page 277.

Fig. 1. A frond, natural size, showing the form and mode of growth.
Fig. 2. An enlargement, showing an unusually compact growth. (× 6.)
Fig. 3. A still further enlargement of a compact growth, showing more distinctly the form of the cell apertures. (× 12.)
Fig. 4. An enlargement, showing distant cell tubes. (× 12.)
Fig. 5. An enlargement, showing the cell tubes parallel to, and in contact with the main axis. (× 3.)
Fig. 6. An enlargement, showing distant, sharply annulated cell tubes. (× 6.)
Fig. 7. An enlargement, showing alternating cell tubes in contact with the main.axis. (× 3.)
Fig. 8. An enlargement, showing the usual mode of growth. (× 3.)
Fig. 14. An enlargement, showing the transverse wrinkles and striations of the cell tubes and main axis. (× 3.)

Hamilton group. *York, Livingston county, N. Y.*

Hederella filiformis.

Page 278.

Fig. 9. A frond, natural size, showing the form and mode of growth.
Fig. 10. An enlargement, showing strongly annulated cell tubes. (× 6.)
Fig. 11. An enlargement, showing the form of the cell tubes and mode of growth. (× 2.)

Hamilton group. *York, Livingston county, N. Y.*

Hederella cirrhosa.

Page 277.

Fig. 12. A frond, natural size.
Fig. 13. An enlargement of fig. 12, showing more distinctly the form of the cell tubes and mode of growth. (× 6.)

Hamilton group. *West Bloomfield, N. Y.*

Hederella magna.

Page 280.

Fig. 15. An enlargement, showing the form and mode of growth of the cell tubes, the annulations and fine longitudinal striations. (× 6.)

Hamilton group. *York, Livingston county, N. Y.*

Hederella Canadensis.

Page 277.

Fig. 16. An enlargement of a frond. (× 3.)

Upper Helderberg group. *Falls of the Ohio river.*

PLATE LXV—Continued.

REPTARIA STOLONIFERA.

Page 274.

Fig. 17. Fragments of fronds, natural size, incrusting *Orthoceras constrictum*, showing the form and mode of growth.

Fig. 18. An enlargement from fig. 17, showing more distinctly the annulated cell tubes and their mode of growth. (× 6.)

Fig. 19. Natural size of a somewhat broader frond than that represented in fig. 17.

Hamilton group. *Cazenovia, N. Y.*

HERNODIA HUMIFUSA.

Page 281.

Fig. 20. Natural size of fronds incrusting *Gomphoceras abruptum*, showing the form and mode of growth.

Fig. 21. An enlargement from the preceding, showing more distinctly the form of the cell apertures and their mode of growth.

Hamilton group. *Cazenovia, N. Y.*

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PLATE LXVI.

Clonopora fasciculata.

Page 289.

Fig. 1. An enlargement, showing the form of the cell tubes and their manner of growth. (× 6.)
Upper Helderberg group. *Onondaga Valley, N. Y.*

Fig. 2. An enlargement from another specimen having somewhat larger cell tubes than the preceding. (× 6.)
Upper Helderberg group. *Onondaga Valley, N. Y.*

Clonopora semireductus.

Page 289.

Fig. 3. A fragment, natural size.

Fig. 4. An enlargement from the preceding, showing more distinctly the form of the cell tubes and their mode of growth. (× 6.)
Upper Helderberg group. *Falls of the Ohio river.*

Clonopora incurva.

Page 289.

Fig. 5. A fragment of a frond, natural size.

Fig. 6. An enlargement of the preceding, showing more distinctly the form of the cell tubes and their spiral mode of growth. (× 6.)

Cystopora geniculata.

Page 103.

Fig. 7. A fragment, natural size.

Fig. 8. An enlargement, showing the ampulliform cell tubes and the constricted apertures. (× 6.)

Fig. 9. An enlargement from a specimen having the outer portion of the cell tubes broken away. (× 6.)

Fig. 10. An enlargement, showing more distinctly the characters illustrated in figure 8.
Upper Helderberg group. *Falls of the Ohio river.*

Thamniscus nanus.

Page 292.

Fig. 11. A fragment, natural size.

Fig. 12. An enlargement of the non-celluliferous face of a frond. (× 6.)

Fig. 13. An enlargement from the celluliferous face, showing the form and disposition of the cell apertures. (× 6.)
Upper Helderberg group. *Falls of the Ohio river.*

Bactropora curvata.

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Fig. 14. A fragment, natural size.

Fig. 15. An enlargement from the preceding, showing the obtusely pointed base, the form and disposition of the cell apertures and the ridges separating them. (× 6.)

Fig. 16. A still farther enlargement, showing more distinctly the characters of the cell apertures. (× 18.)
Hamilton group. *Fall-brook, near Canandaigua lake, N. Y.*

Nemataxis simplex.

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Fig. 17. A fragment, natural size.

Fig. 18. An enlargement of the preceding, showing the form and disposition of the cell apertures. (× 6.)

Fig. 19. An enlargement of a natural section, showing the form and manner of growth of the cell tubes. (× 6.)
Hamilton group. *Darien Centre, N. Y.*

PLATE LXVI—Continued.

BACTROPORA GRANISTRIATA.

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Fig. 20. A fragment, natural size.

Fig. 21. An enlargement from the preceding, showing the pointed, striated base, and the form and disposition of the cell apertures. (× 6.)

Fig. 22. A still farther enlargement, showing more distinctly the character of the cell apertures and the intermediate surface. (× 18.)

Hamilton group. *Darien Centre, Genesee county, N. Y.*

GLAUCONOME CARINATA.

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Fig. 23. Two fragments, natural size.

Fig. 24. An enlargement from the non-celluliferous face, showing the sharp ridges and the mode of branching. (× 6.)

Hamilton group. *Fall-brook, four miles east of Canandaigua lake, N. Y.*

PTILOPORA NODOSA.

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Fig. 25. An enlargement, showing the intervals between the lateral branches, the form and disposition of the cell apertures, and the nodes on the midrib and branches.

Hamilton group. *Near Alden, N. Y.*

PTILOPORA INFREQUENS.

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Fig. 26. A fragment of a frond, natural size.

Fig. 27. An enlargement from the non-celluliferous face of the preceding, showing the manner of growth and alternating striations of the surface. (× 6.)

Fig. 28. A fragment, natural size.

Fig. 29. An enlargement from the preceding. (× 6.)

Hamilton group. *Western New York.*

PTILOPORA STRIATA.

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Fig. 30. A fragment, natural size.

Fig. 31. A specimen, natural size, restored, showing the general appearance and mode of growth.

Fig. 32. An enlargement from the non-celluliferous face of a specimen, showing the appearance of the midrib, lateral branches and dissepiments, and the form of the fenestrules. (× 6.)

Fig. 33. An enlargement from the celluliferous face, showing the form and disposition of the cell apertures. (× 6.)

Hamilton group. *Moscow, Livingston county, N. Y., and West Williams, Ontario.*

FENESTRAPORA BIPERFORATA.

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Fig. 34. A fragment, natural size.

Fig. 35. An enlargement from the non-celluliferous face of a frond, showing the comparative size of the branches and dissepiments, the form of the fenestrules and the perforations of the branches.

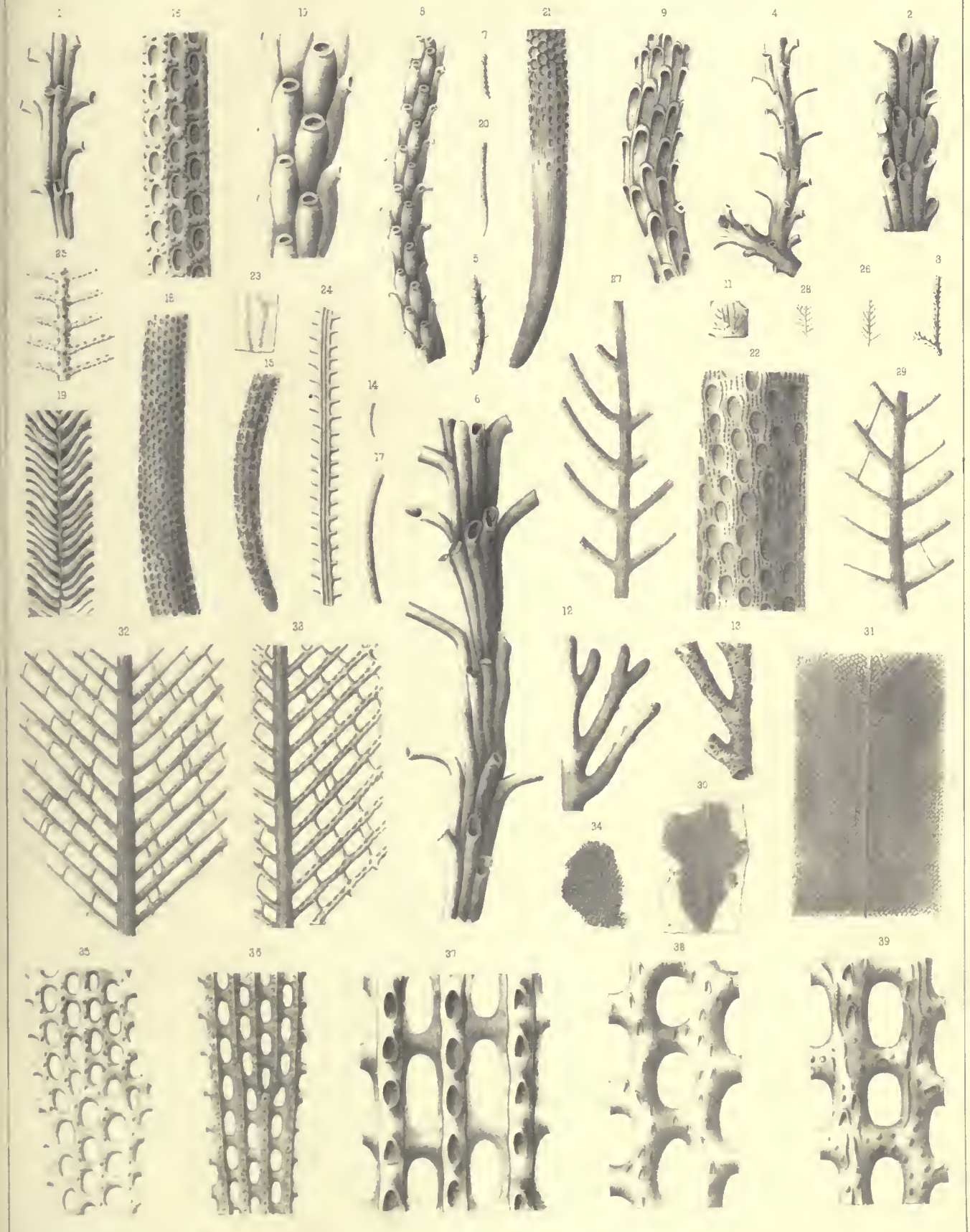
Fig. 36. An enlargement from the celluliferous face; the lower portion of the figure shows the perforated summit of the carinæ; in the upper portion the carinæ are broken away, showing the form and arrangement of the cell apertures. (× 6.)

Fig. 37. A still farther enlargement of the summit of the carinæ, showing more distinctly the oval and triangular perforations. (× 18.)

Fig. 38. An enlargement of the non-celluliferous face, showing triangular perforations, the remainder of the branch being smooth. (× 18.)

Fig. 39. An enlargement from another specimen, showing triangular perforations, short striations and comparatively conspicuous nodes. (× 18.)

Hamilton group. *Moscow, Livingston county, N. Y.*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ERRATA.

Page 12, line 18, for ULRICH read NICHOLSON.
Page 16, line 11, for N. S. G., read HALL. 1886.
Page 40, lines 6 and 7 from bottom, for RHINODICTYA read RHINIDICTYA.
Page 41, line 15, for RHINODICTYA read RHINIDICTYA.
Page 74, lines 2 and 3, for 5, 6, read 6, 7.
Page 83, line 15, for figs. 30–32, read figs. 30–33.
Page 84, line 9 from bottom, for 26 read 27.
Page 96, lines 7 and 9, for 37, 38, read 36, 37.
Page 103, line 21, for 7, 8, read 7–10.
Page 106, the name FENESTELLA PERTENUIS was given to a Niagara species in 1879, and the present species is named FENESTELLA PROUTANA by S. A. Miller, and the name should have been adopted in this volume.
Page 110, line 4 from bottom, for 22, 24, read 22–24.
Page 120, line 4 from bottom, FENESTELLA (RETEPORINA) COALESCENS is a new species.
Page 156, line 2, insert plate xliii, fig. 1.
Page 178, line 7 from bottom, for fig. 6, read fig. 2
Page 179, line 2, for fig. 8, read fig. 9.
Page 182, line 18, for Erie county, read Genesee county.
Page 189, line 1 from bottom, for Erie county, read Genesee county.
Page 193, line 3, NEMATAXIS SIMPLEX is a new species.
Page 193, line 9 from bottom, for Erie county, read Genesee county.
Page 194, line 14, for Erie county, read Genesee county.
Page 215, line 5 from bottom, for 22, read 20.
Page 239, line 9, COSCINELLA ELEGANTULA is a new species.
Page 243, line 16, for Erie county, read Genesee county.
Page 245, line 1, STICTOPORA RECTALINEA is a new species.
Page 246, line 1, STICTOPORA TUMULOSA is a new species.
Page 249, line 9 from bottom, for .15 to .25 mm., read 15 to 25 mm.
Page 266, line 8, PRISMOPORA LATA is a new species.
Page 283, line 17, for 1849, read 1844.
Explanation of plate xxiv under RECEPTACULITES INFUNDIBULIFORMIS for page 289, read page 290; under ISCHADITES SQUAMIFER, for page 290, read page 291; under ISCHADITES BURSIFORMIS, for page 290, read page 291.

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Natural history of New York

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